Has surface test equipment been pressure tested as per program 4176 and PFP-1-6	☐		
Have separator meter checks been performed over full range of expected liquid flowrates	☐		
Has STAN data acquisition system been calibrated	☐		
Have flow safety valves (check valves) been function tested	☐		
Are flowlines, air and relief lines adequately whip checked and secured to deck	☐		
Is lighting adequate in test area	☐		
Are barriers and signs sufficient and appropriate	☐		
ESD system function tested including all ESD stations, hoses, pilots, actuators and panel	☐		
ESD system leak tested panel air supply isolated	☐		
ESD lines inspected and confirmed clear of heat sources (eg. STX vessel) and not exposed to impact damage	☐		
Location of ESD stations - signs displayed prominently and personnel briefed	☐		
Air supply to test separator labeled and locked off from other users	☐		
Fire monitors and portable fire extinguishers in place, including alcohol resistant foam for methanol fire fighting	☐		
Verify UPS battery backup for emergency systems: including ESD, fire and gas is functioning	☐		
Has steam generator feed water been quality checked, and is there sufficient available	☐		
Heat exchanger condensate returns routed to visible, safe location for overside discharge, or if to header tank, header tank is not at higher deck level. Steam trap checked for scale, steam trap functioning. Heat exchanger cleared of water. NRV installed at steam inlet to heat exchanger vessel	☐		
Is the age and service history of steam hoses known and acceptable	☐		
Have the steam hose pressure ratings and steam service ratings been confirmed	☐		
Have steam hoses been routed away from walkways and potential crane set down areas	☐		
Is gas line KO drum (if present) fitted with a sight glass and LSH warning device	☐		
Has the KO drum level alarm been function tested	☐		
Has a minimum level been set in the surge tank sight glasses	☐		
Is all sampling equipment on hand and sampling program fully understood by sampling technician	☐		
Check that all chemical injection pump relief valves have been set and systems are in place to accurately record volumes pumped	☐		
Check that lock out car seals are placed as per P&ID	☐		
Ensure critical tag numbers to valves are labeled on physical valves	☐		

Verify system for measuring material thickness of bends and managing erosion if sand or debris is produced.	☐		
Ensure base line thickness measurements have been performed and recorded prior to testing	☐		
Verify boiler blow down lines rigged up and properly secured	☐		
Verify PSV set points against certs and P&ID	☐		
Verify that gate valve on steam exchanger outlet is locked out	☐		
Confirm PSV's positioned to prevent liquid pockets from forming	☐		
Burners and Booms		**Initial**	**Date**
Boom side stay guy wires secured to secure anchor points without slack. Tensioners should be accessible inboard	☐		
Walkways / handrails in safe condition	☐		
Ignition system electrically inspected and function tested - buttons/panels accessible and in dry areas	☐		
Propane bottles / diesel tanks stored out of the direct radiated heat path	☐		
Burner head orientation optimum for wind direction	☐		
Water screens function tested - working efficiently with all nozzles clear, water lines flushed and clear of scale	☐		
Adequate hoses / cooling in place for rig structure, cranes, winches etc (Reference radiation study)	☐		
Emergency team to have been shown pre laid-out hoses and discussed fire fighting procedures	☐		
Have burner compressors been serviced prior to job and supplied with adequate spares	☐		
Have air compressors been run on load for 1 hour minimum duration	☐		
Are air compressors fitted with spark arrestors and remote ESD buttons (only in Zone 2 area)	☐		
Are air compressors positioned for optimum ventilation and cooling	☐		
Have air line NRV's (check valves) been tested	☐		
Evergreen burner shuttle valve not tied into rig air supply and confirmed operational	☐		
Are procedures for refueling air compressors in place and understood by all parties (rig and well test personnel)	☐		
Are diesel supply and air start hoses clearly labeled and on hand	☐		
Pilot lance has been checked and is available	☐		
Ensure that the fans and air dampers have been shut down where required	☐		
Restocking and change out plan for propane pilots (flare)	☐		
Management plan for water and diesel for boiler	☐		
Confirm nitrogen purge for low pressure vent line is activated and monitoring regime has been set up	☐		

Notification		Initial	Date
Have all relevant authorities been informed that flaring activities are about to commence	☐		
Logistics / helicopter company informed of forward test program - no refueling planned during flow periods, including refresh / reminders, as required	☐		
Communication plan has been implemented for all vessels involved in well test	☐		
Environmental Checks		**Initial**	**Date**
Have well test personnel been briefed on environmental sensitivities, requirements and commitments: particularly for discharge of fluids	☐		
Has an oil spill contingency plan been arranged for this well	☐		
Are adequate oil spill kits available in the well test and air compressor deck areas	☐		
Are high efficiency burners being used	☐		
Are shutdown and alarm systems fully operational	☐		
Have surge tank and KO pot level alarms been function tested prior to flow. Are procedures in place to ensure fast response during emergency shutdowns	☐		
Is manual ESD button positioned near flare watch station to minimize response time in an emergency	☐		
Is the cementer ready to implement flushing procedures at short notice	☐		
Are two flare watchers working on rotating shifts	☐		
Are flare watchers positioned to observe tank vent line outlet during flowing to tank	☐		
Are flare watchers in full time radio communication with Test Supervisor / Crew Chief	☐		
Is there an increased watch provided during night-time flaring	☐		
Is the support vessel available for night time spill watch	☐		
Is the BCO liaising with the support vessel to maintain a safety exclusion zone during testing	☐		
Are dual propane ignitors in operation	☐		
Is there the facility to monitor for, and manage, any sand production	☐		
Are there logs being kept of the cumulative flared hydrocarbon volumes	☐		
All open drains to sea plugged off in the test area	☐		
Confirm that fire pumps have been functioned and the system is pressurized	☐		
Verify toxic gas detectors have been function tested	☐		
Verify explosive gas detectors have been function tested	☐		
Verify that all diesel units have been checked for spark emissions, including boilers	☐		

Check that all pressurized bottles are stowed away from hazardous areas (nitrogen, propane shielded / cooled from flare)	☐		
Test water screens and ensure adequate cover for flaring	☐		
Heating protection on >160-deg. F lines	☐		
Red Box Item Checks		**Initial**	**Time**
Surface, Slickline, Subsea and DST/TCP equipment checklists completed and verified	☐		
Final safety inspection of well test area (walk-around) conducted by Well Site Manager, MMS and OIM	☐		
Warnings/barriers erected to warn personnel of hot/pressurized pipe work	☐		
STAN data acquisition alarm set points set and understood	☐		
Lab cabin shut-down systems checked (positive pressure drop, gas detection)	☐		
Is lab cabin air intake routed to safe area	☐		
Has the test deck and surrounding area been checked for non-IS electrical equipment and ignition sources	☐		
Permits to work in place including review/cancellation of all other hot-work permits	☐		
Crane operations shut down and on boom rest as required	☐		
All explosives off the rig (on boat) or on jettisonable bunkers	☐		
Air intakes/vents open/closed as appropriate and tagged as required	☐		
ESD system function tested, witnessed and logged (all stations)	☐		
JSA/JHA conducted prior to flowing the well	☐		
Personnel assigned with gas detector to check line for leaks while flowing	☐		
Propane pilots alight	☐		
Rig water screens operating	☐		
Burner boom water screens operating	☐		
All water-tight doors and hatches closed and tagged out	☐		
Non essential personnel clear of test area	☐		
Valve status board current and line-up confirmed	☐		
Cement unit isolated and lined up ready to pump kill fluid (confirmed by cementer)	☐		
Sufficient number of air compressors on load for anticipated flowrate	☐		
Steam generator / heat exchanger up to temperature	☐		
All low pressure pilots isolated during well opening	☐		
All needle valves on sample points and vents closed	☐		
STAN data acquisition system running on rapid scanning rate as per program	☐		
Flare watchers in position and aware of responsibilities, radio communication checked	☐		
Flare watcher positioned to observe tank vent (initial flow to tank)	☐		

Support vessel notified of impending flaring operations and briefed on duties during testing	☐		
Radio check - Driller, Flare Watch, Test Crew. Channel confirmed and all batteries charged	☐		
PA announcements made regarding well test start-up	☐		
Confirm that radio and telephones are functioning correctly	☐		
Ensure adequate direct communications channels to Enterprise production and rig control room is working and tested	☐		
Verify that kill lines and pump are working correctly and that it is correctly lined up to the kill wing on the flowhead	☐		
Confirm that a sub-sea manifold pressure monitoring system is in place, that this is well understood and pressure management responsibilities are clear	☐		
Verify that all personnel know the ESD locations and how to function them. Include in a JRA or as required	☐		
Verify that the Hot Work Permits have been returned	☐		
Verify that lifting restrictions have been imposed over test area and pressurized lines	☐		
Confirm that all relevant gas tight doors have been shut	☐		
Confirm that all fireguards are in place	☐		
Ensure that barriers are in place around test area and permit to work system is understood	☐		
Ensure steam supply is ready to output steam to well test plant	☐		
Walk the lines and verify complete line up from the flowhead to the burners and tanks	☐		
Ensure that air compressors are on and running	☐		
Ensure that the Well Test Contractor Data acquisition systems are up and running. Synchronize system with Enterprise	☐		
Ensure that the Methanol and chemical defoamer, demulsifier, antiaglomerate system is on	☐		
Verify that all monitoring sensors are checked and working	☐		
Verify that minor spill mop equipment is available around the well test area and that a mud vacuum system is also available and operational	☐		
Confirm bunding status of the test area and ensure risks of overboard spill via drains has been addressed	☐		
Steam line protection in place and risk awareness regarding leaks communicated to all relevant crews on a regular basis	☐		
[redacted]		[redacted]	[redacted]
Consider fire drills to be carried out in test area	☐		
Ensure fire drills have tested all protection equipment for well testing process and hazardous areas (e.g. Methanol storage)	☐		

Verify that all breathing apparatus has been checked for serviceability and ensure all crews understand the protection afforded by cartridge filters	☐		
Confirm that all fire-fighting appliances have been inspected and correctly positioned	☐		
Verify lifeboat engines have been function tested	☐		
Verify lifeboat-launching equipment has been function tested and lifeboats correctly positioned	☐		
Confirm life jackets and survival suits are checked and in good condition	☐		
Verify that riser flush fluid has been prepared in suitable quantities	☐		
Verify fire-extinguishing appliances are positioned next to the relevant risk areas	☐		
Ensure emergency wash showers are available and that one or two crew members have suitable protective suits to manage brine	☐		
Trip hazards identified and marked	☐		
Verify MSDS sheets for all well test and production chemicals fluids	☐		
Verify proper PPE for chemical and hydrocarbon handling is available and used	☐		
Operations		**Initial**	**Date**
Review of Start-Up and Ops Procedures with all applicable personnel on rig	☐		
Conduct joint review of Enterprise / Q4000 joint operating philosophy / procedure	☐		
Weather expectations and shut-down and disconnect drills have been done by both crew to ensure specific rig operation instructions are known	☐		
The initial flow of hydrocarbons to surface should be timed to coincide with daylight hours	☐		
Conduct a fire drill and abandonment drill prior to testing. Ensure all alternate escape routes are known by all crews. Continue regularly during and after start-up	☐		
Verify that people are clear about the well test plan, their roles and responsibilities	☐		
Ensure there have been 2 pre-test general meetings, 1 per tour	☐		
Confirm all communication channels have been tested and confirmed	☐		
Verify status of sub-sea infrastructure	☐		
Inform the rig control room when test operations are about to commence and when the well actually opens; including shut-downs	☐		
Check that the required statutory authorities have been informed	☐		
Check that adjacent vessels, Enterprise rig and helicopter base have been informed	☐		

Methanol control from Enterprise has been confirmed	☐		
Conduct daily inspections of steam boiler	☐		
Check BS&W water legs on all test vessels periodically for wax	☐		
Monitor all 3-in inlets and lines. including coflexip. for vibration every 12-hours	☐		
Perform periodic wall thickness checks for comparison to baseline measurements checking for erosion	☐		
Confirm data transmission of key test parameters to Houston via SLB Interact and BP Process Net	☐		
Confirm high vibration lines have been clipped / welded down	☐		
Regularly check cold vent / PSV for flow	☐		
Maintain safety drive bypass log / procedures	☐		
Conduct regular flare zone temperature reading / surveys	☐		
Permit system in place (COW) and functioning	☐		
Ops to establish daily tracking sheet for all the above	☐		

Attachment 7: Offshore Air Monitoring Plan for Source Control, Doc. 4002 DRAFT

SPU bp

GoM Drilling, Completions and Interventions -

Deepwater Horizon MC252 Response

OFFSHORE Air Monitoring Plan for Source Control

*RPIC APPROVAL: JEFF HOWLE (PRINT Name above) (Sign Above) 6/11/10 Time: 1520

*CGIC (USCG) APPROVAL: Reviewed (PRINT Name above) (Sign Above) 11 June 2010 15:45 Time:

* REQUIRED

Rev	Date	Document Status	Custodian/Owner	Authority
5	06/11/2010	Approval - Issue for GoM Use	Joseph Gallucci	Ross Kerns
4	05/24/2010	Approval - Issue for GoM Use	Ben Gehring	Ross Kerns
3	05/22/2010	Approval - Issue for GoM Use	Ben Gehring	Ross Kerns
2	05/18/2010	Approval - Issue for GoM Use	Lindsey Parker	Ross Kerns
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AMENDMENT RECORD

05/07/2010	0	K. Murray-Del Aguila	Approved - Issued for Use
5/12/2010	1	S. Briggs	Approved – Issued for Use – Revised document to add language on drive-off levels for Benzene and added a section on respiratory protection.
5/18/2010	2	L. Parker	Approved – Issued for Use – Revised document to update title of incident from "MC252" to Deepwater Horizon Response. Clarified this document to pertain to Offshore Source Control area (removed language around "skimming operations"). Added language on respirator cartridge change-out schedule; added section on Vessel Cabin Air Quality Control which outlines the use of activated charcoal filters in HVAC intake units
5/22/2010	3	B. Gehring	Approved – Issued for Use – Revised document to clarify the recommended actions specified in Tables 4.1 Action Levels for Personal Exposure and 4 2. Action Levels for Safe Operations.
5/24/2010	4	B. Gehring	Approved - Issued for Use - Revised document to update title of incident from Deepwater Horizon Response to Deepwater Horizon MC252 Response. Removed "skimming vessels" from Tier III designation to clarify and relate document to Offshore Source Control. Revised document to clarify the recommended actions specified in Tables 4.1 Action Levels for Personal Exposure (added full-faced respirators). Revised Section 4 Site Action Levels document to clarify sampling procedures and PPE use. Clarified respirator cartridge service life table (referenced relative humidity, temperature, cartridge brand and values in table footnote). Revised respirator use information (now included in Action Level table)
6/11/2010	5	J. Galluccl	Approved - Issued for Use - Revised document to add firefighting and dispersant vessels into Tier II vessels. In Section 2 added sulfur dioxide, particulate monitoring and Attachment 1. In table 4.1 added action levels for sulfur dioxide and particulate matter. Action levels for personnel exposure to include actions at 20, 75 and 100 ppm SO. In Section 5 added evacuated canister sampling. In Section 7 added EPA air quality information, sulfur dioxide and particulate matter as a hazard and P100 filter to cartridge change out list. Section 8 updated filter procurement process. Section 13 updated IH Unit phone number.

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Warning: Check DW Docs revision to ensure you are using the correct revision.

TABLE OF CONTENTS

1 Introduction

This plan is intended to minimize the risks to workers who are performing Source Control for the Deepwater Horizon incident. The origin of the oil released from the incident is located approximately 50 miles southeast of Venice, Louisiana and has the potential to impact the shore line, offshore assets, drilling rigs and other operations with oil.

This plan addresses air monitoring and sampling during the mitigation operations of the impacted areas. Thus, the purpose of this sampling includes the following:

- Monitor the air around the mitigation activities to protect potential downwind receptors.
- Monitor air in the vicinity of mitigation activities to protect workers.
- Monitor specific activities to support safe operations.

Air monitoring will continue until the mitigation process is complete. Air monitoring and sampling data will be summarized and reported to Unified Command through the Houston IMT Safety Officer

An operational risk-based approach will be employed in the implementation of this plan and will involve a three-tiered system. These tiers are identified as follows

- Tier I – High Priority - Vessels which are attached or essentially attached to the sea floor, e.g. drill ships.
- Tier II – Moderate Priority - ROV support, fire-fighting, and surface dispersant vessels that can move off with short notice.
- Tier III – Reduced Priority - Supply Vessels and other vessels which can easily move in and out of the Source Control area.

2 Air Monitoring Instrumentation

In order to ensure all vessels receive timely technical support for the air monitoring and respiratory protection programs, it is critical that the Safety Unit be informed of the addition of any new vessels as soon as possible as outlined in Attachment 1.

Real-time air monitoring for Volatile Organic Compounds (VOCs) will be performed during source control activities. Air monitoring will be performed using photo-ionization detectors (PIDs) and the UltraRAE benzene monitor. The PIDs will be used to detect volatile components of the crude oil. The UltraRAE will be used for benzene specific analysis in the event that elevated VOCs are detected using a PID. The UltraRAE is equipped with a 9.8 eV lamp. Real-time monitoring will be conducted using multi-gas detectors (e.g. Rae Systems AreaRAE) with photoionization detectors (PID) equipped with 10.6 eV lamps for VOCs (ppm), catalytic bead sensor for 0-100% lower explosive limit (LEL%) and additional electrochemical sensors that measure Oxygen (%), Hydrogen Sulfide (ppm) and Carbon Monoxide (ppm).

Additional monitoring will be conducted for sulfur dioxide (SO_2) and particulate matter (PM10) for source control vessels that will be burning both an oil stream and a gas stream as part of containment or production activities. This monitoring may be expanded to include other ancillary vessels at the discretion of the Source Control BP Industrial Hygienist or approved designate.

Real-time particulate matter (PM10) monitoring will be conducted using stationary and portable Thermo or TSI PM10 data logging monitors. Real-time sulfur dioxide monitoring will be conducted using stationary (retrofitted AreaRAEs) and portable single gas SO_2 monitors (MSA Altair 5) will be used to conduct appropriate monitoring.

The term "real-time" refers to direct reading instruments that allow nearly instantaneous determinations of a chemical concentration in air. Real-time measurements provide immediate information for targeted

compound concentrations in the area and are used to trigger mitigation actions to protect workers. Real-time measurements are not directly comparable to OSHA or ACGIH 8-hour TWA values or to community exposure standards or guidelines. Instantaneous real-time samples do not necessarily represent conditions experienced throughout the workday and can substantially underestimate or overestimate exposures potentially experienced by workers. Direct reading instruments perform sampling and analyses within the instrument and concentration readings can usually be obtained immediately. These instruments have fast response times and can follow rapid changes in concentration.

3 Site Monitoring Locations

Vessel operators will work with the Air Monitoring Technicians to select real-time monitoring locations in common work areas and inside crew quarters. Additional monitors may be placed near the edge of the vessel or in other areas of interest, such as moon pools, to gain early indications of rising LEL levels. Handheld monitors are also available to sample in real-time for LEL, VOCs, H2S, and benzene. Manually logged real-time data for benzene will be collected and reported on approved field forms at prescribed intervals. This data will be shared with response stakeholders.

After initial characterization of the immediate work site has been completed, air monitoring will be continued at regular intervals in the vicinity of operations being conducted. The air monitoring results shall be sent to the Industrial Hygiene Unit Leader in Houston for review at intervals not to exceed 12 hours. At no time, though, shall air monitoring activities impede operations or endanger personnel.

The Air Monitoring Technician will determine location(s), time and duration of air monitoring. Where continuous monitoring instrumentation is not installed, the Air Monitoring Technician will default to monitoring every hour or as conditions change until personnel suspend operations or depart the work site. In addition to general area monitoring aboard vessels, a specific request has been made to conduct air monitoring by exhaust vents or ballast vents which discharge into the work area. If conditions change (such as the amount of oil in the work area, an increase in a reading of VOCs, or a shift in the winds towards the workers, for example), air monitoring should be done immediately following the change, and the need to monitor more frequently should be considered.

Source control site personnel and supervisors shall be updated regularly of the air monitoring results. At minimum, the Air Monitoring Technician shall update the OIM of levels over the preceding 12 hours once per shift.

4 Site Action Levels

Site action levels have been established for airborne hazards. Vessels should execute their own safety evacuation/emergency response plan when action levels are exceeded.

NOTE: For any action levels triggering the use of half-face respirators, non-vented goggles are recommended to reduce the potential for eye irritation. 3M 8577 P-95 masks are available for nuisance odors and can be used up to 100 ppm VOCs and 0.5 ppm benzene.

4.1 Action Levels for Personnel Exposure

Chemical	Action Level (all deck and living areas)	Monitoring Condition	Actions
VOC, ppm	50	Continuous levels for > 15 minutes	• At the OIMs or Captain's discretion, deploy standby vessels for dispersant or foam application (if approved) or utilize water cannons to break up sheen. • Take additional benzene specific readings to determine benzene levels.
VOC, ppm	100	Continuous levels for > 15 minutes	• Increase airflow with portable industrial fans • Don half-face OV or OV/AG/P100 cartridge respirators to continue working in the area. • Non-essential personnel should relocate to an area of lower concentration (i.e., move to different location on the vessel or move to the living quarters or galley) • Re-orient vessel into wind • At the OIMs or Captain-s discretion, deploy standby vessels for dispersant or foam application (if approved) or utilize water cannons to break up sheen.
VOC, ppm	300	Continuous levels for > 15 minutes	• Don full-face. OV or OV/AG/P100 cartridge respirators to continue working in the area.
VOC, ppm	1000	Continuous levels for > 15 minutes	• Move vessel off location

Benzene, ppm	**0.5 (on deck or in living quarters)**	At least 3 samples over 15 minutes	• Increase airflow with portable industrial fans. • Don half-face OV or OV/AG/P100 cartridge respirators to continue working in the area. • Non-essential personnel should relocate to an area of lower concentration (i.e., move to different location on the vessel or move to the living quarters or galley) • Re-orient vessel into wind. • At the OIMs or Captains discretion, deploy standby vessels for dispersant or foam application (if approved) or utilize water cannons to break up sheen.
Benzene, ppm	**10 (on deck)**	At least 3 samples over 15 minutes	• Personnel should relocate to an area of lower concentration. • Don full-face, OV or OV/AG/P100 cartridge respirators to continue working in the area. (Maximum concentration for this respirator is 50 ppm)
Benzene, ppm	**10 (living quarters)**	Sustained for 15 minutes as confirmed by two instruments	• Move vessel off location.
Carbon Monoxide, ppm	**25**	Continuous levels for > 15 minutes	• Evacuate immediate work area to area of lower concentration
Hydrogen Sulfide (H_2S), ppm	**5**	Continuous levels for > 15 minutes	• Evacuate immediate work area to area of lower concentration
Sulfur Dioxide (SO_2), ppm	**1**	Continuous levels for > 15 minutes	• Personnel should relocate to an area of lower concentration. • Don half-face, OV/AG/P100 cartridge respirators to continue working in the area.
Sulfur Dioxide (SO_2), ppm	**20**	Continuous levels for > 15 minutes	• Don full-face, OV/AG/P100 cartridge respirators to continue working in the area.

Sulfur Dioxide (SO_2), ppm	75	Continuous levels for > 15 minutes	• Adjust flaring operations to reduce sulfur dioxide levels.
Sulfur Dioxide (SO_2), ppm	**100	Instantaneous reading on 1 monitor.	• Shutdown flaring operations
Particulate Matter (mg/m^3) (PM10)*	0.2	Continuous levels for > 15 minutes	• Personnel should relocate to an area of lower concentration. • Don half-face OV/P100 or OV/AG/P100 cartridge respirators to continue working in the area.
Particulate Matter (mg/m^3) (PM10)*	2	Continuous levels for > 15 minutes	• Don full-face OV/P100 or OV/AG/P100 cartridge respirators to continue working in the area.

*PM10 - measures particulate matter less than 10 microns aerodynamic diameter.

** This level is considered immediately dangerous to life or health (IDLH) by NIOSH.

Above the Action Level, a beeping alarm with a red flashing light will sound on the monitor where the result was detected. Once the action level has been consistently above the limit for 15 minutes, the Air Monitoring Technician will notify the crew to leave the immediate area to an area of lower concentration (i.e., move to different location on the vessel or move to the living quarters or galley). Additionally, the Air Monitoring Technician will immediately inform the OIM that a consistent reading has been confirmed and that the area of the vessel in which the monitor is located is considered a restricted area. The area will remain a restricted area until levels are consistently below the action limit. Air monitors indicate levels in the immediate environment surrounding the monitor.

If the VOC concentration remains below 50 ppm for 12 hour duration, a confirming benzene measurement using a handheld UltraRae shall be conducted. In the event a VOC concentration of 50 ppm or greater is registered using the Area Rae monitoring equipment during any reporting period, a secondary benzene measurement utilizing handheld UltraRae equipment shall be conducted. The Air Monitoring Technician will verify that the action level is sustained by collecting at least three samples over a 15 minute period using a hand held MultiRae. A new separator tube should be installed before conducting each verification test. If the greater than 10 ppm (on deck) action level is confirmed, the area will be considered a restricted area until levels are consistently below the action limit for 15 minutes. The Air Monitoring Technician will notify the crew to leave the immediate area to an area of lower concentration. If the levels of benzene to unprotected workers in the living quarters exceed 10 ppm sustained for 15 minutes as confirmed by two instruments, the vessel should drive off of the location and the living quarters should be ventilated with clean air. Additionally, the Air Monitoring Technician will immediately inform the OIM that a consistent reading above the action levels has been confirmed and that the area of the vessel in which the monitor is located is considered a restricted area.

When levels of VOC or benzene exceed action level, work may continue in the restricted area by wearing a respirator with organic vapor cartridges. Prior to allowing the use of respiratory protection, the vessel must put in place a respiratory protection program which includes training, medical certification, and fit-testing of personnel that are performing work in restricted areas (see Section 7 Respiratory Protection for more detail). If there is potential to come in contact with hydrocarbon contaminated material, additional personal protective equipment should be considered based on the task including nitrile or neoprene gloves, PVC boots, and slicker suits.

At the OIM's discretion, the vessel may implement other controls to reduce airborne hazards below action limits such as moving portable industrial fans to increase air flow, repositioning the vessel, notifying

standby boats with water cannons to break up sheen in the immediate area or requesting application of dispersants or foams from standby boats, if approved. It is recommended that each vessel install activated charcoal filters on the ventilation system intakes to provide a clean air environment within the crew quarters.

4.2 Action Levels for Safe Operations

Hazard	Action Level	Monitoring Condition	Actions
Flammable, %LEL	10%	Continuous levels confirmed by 2 or more monitors for 15 minutes	• Notify the OIM that control measures are required. The OIM will evaluate and implement controls to reduce LEL levels below the 10% action level. (See more details in the paragraphs following this table.)
Flammable, %LEL	40%	Instantaneous reading confirmed by 2 or more monitors	• Move off location.

Lower Explosive Limit (LEL) action levels are designed to create a safe operating environment. The 10% LEL action level is designed to indicate that action is needed to reduce airborne hazard levels. This level is confirmed by detection of 10% or more LEL consistently on 2 or more monitors for 15 minutes. At this level, the Air Monitoring Technician should notify the OIM that control measures are required. The OIM will evaluate and implement controls to reduce LEL levels below the 10% action limit such as moving or repositioning the vessel, notifying standby boats with water cannons to break up sheen in the immediate area or requesting application of dispersants from standby boats.

When the LEL level is between the 10% and 40% LEL action levels, Notify the OIM that control measures are required. The OIM will evaluate and implement controls to reduce LEL levels below the 10% action level.

The 40% LEL action level or exceedence of the benzene (>10 ppm in living quarters) action level indicates when immediate action for safe operation is required. This level is confirmed by detection of 40% or greater LEL instantaneously on 2 or more monitors at the same time, or by detection of >10 ppm benzene continuous in living quarters as confirmed by 2 or more monitors at the same time. At this level, the Air Monitoring Technician will immediately notify the OIM this level was confirmed. The OIM will suspend vessel operations and the vessel will drive-off location to the safe zone and await further instructions. A ship announcement will be made upon notification by the Air Monitoring Technician (or any crew member) to the OIM. The OIM will communicate moves through the appropriate SIMOPS Coordinator. Prior to re-entry, other support vessels will verify the LEL is below the action limit and communicate results to the affected vessel.

Utilize other support vessels or small crew boats in the vicinity that are equipped with AIR MONITORING Techs and monitoring equipment to provide clearance monitoring. The clearance monitoring will provide information to the main vessel when it is safe for the vessel to re-enter the area.

5 Monitoring of Personnel

Organic Vapor Monitor (OVM) badges will be used to assess personnel exposures to benzene and other hydrocarbons. OVM badges are to be placed on personnel identified as having the highest potential for exposure. Exposure monitoring will be conducted on workers who spend the most time on the deck each day. A representative population to be sampled will be determined by the BP Industrial Hygienist (Source Control) or approved designate. OVM badges will be analyzed by Bureau Veritas, American Industrial Hygiene Association accredited laboratory, using an OSHA Method 7 for analysis. Results will be communicated to personnel and supervisors via the contact information provided to the Air Monitoring Technician.

In order to help validate and interpret results of the OVM badge analytical data, evacuated canisters will be used to take integrated area air samples for VOC and other chemicals using EPA method TO-15 analysis.

6 Data Quality and Documentation Management

The following applies to data quality and documentation management

- All analytical air sample results will be sent to the Industrial Hygiene Lead in the Houston Command Center.
- Bureau Veritas, an AIHA Accredited Laboratory, located in Novi, Michigan will be used to analyze the samples
- The data packets will be reviewed and the data will undergo a data validation process.
- All real-time instruments will be calibrated according to the manufacturer recommendations or shall be maintained and calibrated as necessary to ensure consistent reliable data production.
- Calibration will be documented by the Air Monitoring Technician daily and documented on the calibration log.
- Real-time readings will be documented by handwritten notes, handheld PDA, or by the use of data logging capabilities of the instrument, if available
- Real-time data will be entered onsite and drafts made available upon request
- The IH Unit Leader in Houston will provide data summaries to the Safety Officer.

7 Respiratory Protection

Personnel in the response action may be required to wear a respirator when conditions dictate their use as outlined in Table 4.1. All response organizations are following their appropriate respiratory protection programs in compliance with applicable governing regulatory bodies. These programs are inclusive of appropriate training qualifications, as well as procedures for the safe use of respirators in conjunction with the Deepwater Horizon response.

Contaminants that are potential respiratory hazards are:

- Volatile Organic Compounds (VOCs);
- Benzene
- Hydrogen Sulfide

- Carbon Monoxide
- Sulfur Dioxide, and
- Particulate Matter (PM10)

Action levels have been established in table 4.1 for sulfur dioxide and particulate matter. In addition the US Environmental Protection Agency (EPA) has issued guidance on air quality and health for levels that are below this plans' action levels for the general public and unusually sensitive people. The EPA advises that asthmatics and people with heart and lung disease take appropriate preventive action such as reducing or avoiding physical activity outdoors. More detailed information can be found in the document named Air Quality Index - A Guide to Air Quality and Your Health (EPA -45/K-03-002. August 2003.)

Employees are being recommended to be fit tested quantitatively. However, response companies may fit test their employees qualitatively in conjunction with their company's operational safety requirements. BP will still recommend and will provide these companies' employees an opportunity to undergo a quantitative fit test. Fit testing and respirators will be provided and used as follows:

Fit Testing Procedures:

Offshore Fit Testing is being performed in order to provide additional mitigation and a measure of comfort and assurance. Below are the steps that out line the offshore fit testing.

- Operations will need to contact the Houston IMT – Health and Safety Unit to request fit testing. This office can be reached at (281) 366-0863 or (281) 366-2232
- Operations will need to provide a contact on the vessel to receive an instruction packet for the fit testing program.
- Health and Safety Unit will coordinate fit testing with the Qualified Technicians.
- Employees will have to complete the Medical Evaluation questionnaire (MEQ) for medical approval. The questionnaire will need to be faxed, scanned, or delivered as per the instruction packet.
- Once medically approved, individuals will be fit tested on the mask type and size they will be using. Additionally, Individuals must receive Respirator Training prior to using the respirator. Individuals being fit tested must be clean shaven according to the packet guidelines.
- After fit testing, users will be given a respirator selection card, which show the type and size of mask they were fitted on

Onshore Fit Testing is also being performed to further expedite the fit testing process. Onshore fit testing should be utilized for fit test individuals who are rotating onto the vessels, as they show up at the Heliport. Below are the steps that outline the onshore fit testing program.

- Fit testing trailer will be set up at the Heliport South Parking lot, and is located in the "Core" trailers.
- Personnel designated by Vessel Operator/BP for fit testing complete a MEQ, the MEQ is then reviewed onsite by a Medical Professional for approval.
- If approved for fit testing, the individual will be fitted and tested on the type and size of mask the individual will be utilizing.
- Each crew member will need to complete respirator training prior to being allowed to wear the respirator.
- Onshore fit testing has been set up to fit test individuals before or after crew change occurs.

- After fit testing, users will be given a respirator selection card, which show the type and size of mask they were fitted on.

Respirator cartridges need to be changed-out/replaced on a daily schedule (i.e. should be replaced at the end of every work-shift and not to exceed 16-hours). Please see the specific respirator change-out details listed by manufacturer below.

To order half and full face respirators and cartridges please contact the Total Safety representative on board to fill out a Vessel Daily Report (VDR) or contact BP Onshore Logistics at 281-366-6968 with specific type, size and quantity of respiratory equipment.

Respirator Cartridge Service Life Summary[1]			
Cartridge[2]	**Contaminant**	**Value[3] (ppm)**	**Change-Out**
3M 8577 P-95 Mask	n/a	n/a	End of Shift[4]
3M 6001 OV	Benzene	5.1 - 10.0	7 Hours
3M 6001 OV	Benzene	1.1 - 5.0	8 Hours
3M 6001 OV	Benzene	0 - 1.0	End of Shift[4]
3M 6003 OV/AG	Benzene	5.1 - 10.0	6 Hours
3M 6003 OV/AG	Benzene	1.1 - 5.0	7 Hours
3M 6003 OV/AG	Benzene	0 - 1.0	End of Shift[4]
3M 60923 OV/AG/P100	Benzene	5.1 - 10.0	6 Hours
3M 60923 OV/AG/P100	Benzene	1.1 - 5.0	7 Hours
3M 60923 OV/AG/P100	Benzene	0 - 1.0	End of Shift[4]
3M 60923 OV/AG/P100	Sulfur Dioxide	76 - 100	4 hours
3M 60923 OV/AG/P100	Sulfur Dioxide	21 - 75	7 hours
3M 60923 OV/AG/P100	Sulfur Dioxide	0 - 20	End of Shift[4]
3M 6001 OV or 3M 60923 OV/AG/P100	VOCs[5]	301 - 1000	2 hours
3M 6001 OV or 3M 60923 OV/AG/P100	VOCs[5]	151 - 300	4 hours
3M 6001 OV or 3M 60923 OV/AG/P100	VOCs[5]	11 - 150	8 hours
3M 6001 OV or 3M 60923 OV/AG/P100	VOCs[5]	0 - 10	End of shift[4]
3M 60921OV/P100 or 3M 60923 OV/AG/P100	Particulate Matter	Not Applicable[5]	End of shift[4]

1 - This information was obtained from the 3M Respirator Cartridge Service Life Indicator Software assuming medium work rates, relative humidity of 90% and temperature of 86 degrees Fahrenheit.

2 - Service life summary is based on 3M cartridges and should not be used with other cartridge manufacturers.

3 - Values are based on average readings over a work shift.

4 - "End of Shift" refers to the work day at less than 16 hours.

5 - Total VOC values are based on Xylene as the cartridge contaminant.

Title of Document:	OFFSHORE Air Monitoring Plan for Source Control	**Document Number:**	2200-T2-DO-PN-4002
Authority:	Safety Officer/Sr. Industrial Hygienist	**Revision**	5
Custodian/Owner:	Joseph Galluccl	**Issue Date:**	5/7/2010
Retention Code:	ADM3000	**Next Review Date (if applicable):**	5/3/2011
Security Classification:	Project Confidential	**Page:**	Page 14 of 21
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6 - *Respirators or filters should be changed if they become damaged, soiled, or an increase in breathing resistance becomes noticeable.*

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Authority:	Safety Officer/Sr. Industrial Hygienist	**Revision**	5
Custodian/Owner:	Joseph Salucci	**Issue Date:**	5/7/2010
Retention Code:	ADM3000	**Next Review Date (if applicable):**	5/3/2011
Security Classification:	Project Confidential	**Page:**	Page 15 of 21
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8 Vessel Cabin Air Quality Control

Activated charcoal Heating Ventilating and Air Conditioning (HVAC) filters are recommended to reduce odor infiltration into living quarters. Activated charcoal absorbs gases such as ozone, nitrogen oxide, sulfur dioxide and hydrocarbons. The fitted activated charcoal filters are the preferred style of filter for Tier 1 and Tier II vessels as outlined in Section 1 of this plan. The roll type activated charcoal filter is not preferred for Tier I or II vessels but may be used on Tier III vessels if needed. The roll type activated charcoal filter may be cut to fit the dimensions of the HVAC system. If a Tier I or Tier II vessel can not get the fitted filters in a timely manner they may use the roll type filter in the interim until the fitted (preferred) filter arrives.

To order fitted filters or the roll type filter please contact the Total Safety representative on board to fill out a Vessel Daily Report (VDR) or contact BP Onshore Logistics at 281-366-6968 with the specific filter dimensions including intake dimensions (ID), current filter dimensions (OD) and thickness of the filter.

MWV Specialty Chemicals
HM Filter -MeadWestvaco Activated Carbon Filtration
1-800-348-7196
www.mwvspecialtychemicals.com

Air Filters, Inc
Honeycomb Carbon Air Filters
1-800-667-8563
www.airfilterusa.com

Air Flow Technology
Carbon impregnated pleated filters
1-800-537-5454
www.airflowtechnology.com

Aeron
GC Activated Carbon Filter
Phone: +47 38 32 78 00
www.aeron.nc

Flanders Filters, Inc.
531 Flanders Filter Road
Washington, NC 27889
Phone. (252) 946-8081
Toll Free. (800) 637-2803
Fax. (252) 946-3425
Website. www.flanderscorp.com

- Filter Change-out Frequency: To best determine a change-out frequency of filters for each vessel it is recommended to use VOC monitors to measure levels (on indoor-side of HVAC) twice daily. (i.e. once in the morning and again in the afternoon). If levels inside cabin exceed 50 ppm VOC action limit, change filter.

9 Qualified Personnel

Personnel who serve as Air Monitoring Technicians or Industrial Hygienists for this response shall be qualified in accordance with their respective organizations' policies to perform initial site surveys and site monitoring using appropriate atmospheric equipment for oil spill response, recovery and remediation activities.

10 Roles & Responsibilities of Air Monitoring Technicians

The Air Monitoring Technician's role is to ensure that personnel performing spill clean-up operations or working on the deck of response vessels are not being overexposed to benzene and other hydrocarbons

The Air Monitoring Technician's responsibilities include:

- Calibrating air monitoring instruments daily.
- Conducting air monitoring according to the plan and keeping written documentation of results.
- Conducting follow-up air monitoring within 15 minutes to confirm readings when results exceed the action limit.
- Informing the OIM / lead supervisor / captain on the vessel immediately when results exceed action limits, so that the supervisor / captain can implement controls to protect personnel.
- Provide periodic updates of air monitoring results to the lead supervisor / captain on the work site / vessel
- Provide copies of the air monitoring results to the Houston Industrial Hygiene Unit Leader and to the Houston IMT Safety Officer every 12 hours.

11 Equipment Decontamination

No field instruments/equipment decontamination is required under foreseeable conditions. Respirator masks should be cleaned and maintained with the appropriate cleansing/disinfecting wipes provided and in accordance with respirator manufacturer's care and maintenance instructions.

12 Calibration and Maintenance of Field Instruments

The calibration, usage, and maintenance of field equipment and instrumentation will be in accordance with each manufacturer's specifications or applicable test/method specifications. At least two back up AreaRae instruments, one UltraRae instrument and replacement supplies will be maintained aboard the vessel.

13 Questions or Concerns:

Personnel have been instructed to contact their Supervisor if they have concerns about their health due to changing workplace conditions.

These Questions or concerns shall be directed to the Safety and Health Unit so they can be assessed:

Houston Source Control:

Safety Officer: 281-366-0863

Safety & Health Unit Leader: 281-366-5520

Industrial Hygiene Unit Leader: 281-366-1746

Title of Document:	OFFSHORE Air Monitoring Plan for Source Control	**Document Number:**	2200-T2-DO-PN-4002
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Custodian/Owner:	Joseph Galfucci	**Issue Date:**	6/7/2010
Retention Code:	ADW300C	**Next Review Date (if applicable):**	5/3/2011
Security Classification:	Project Confidential	**Page:**	Page 13 of 21
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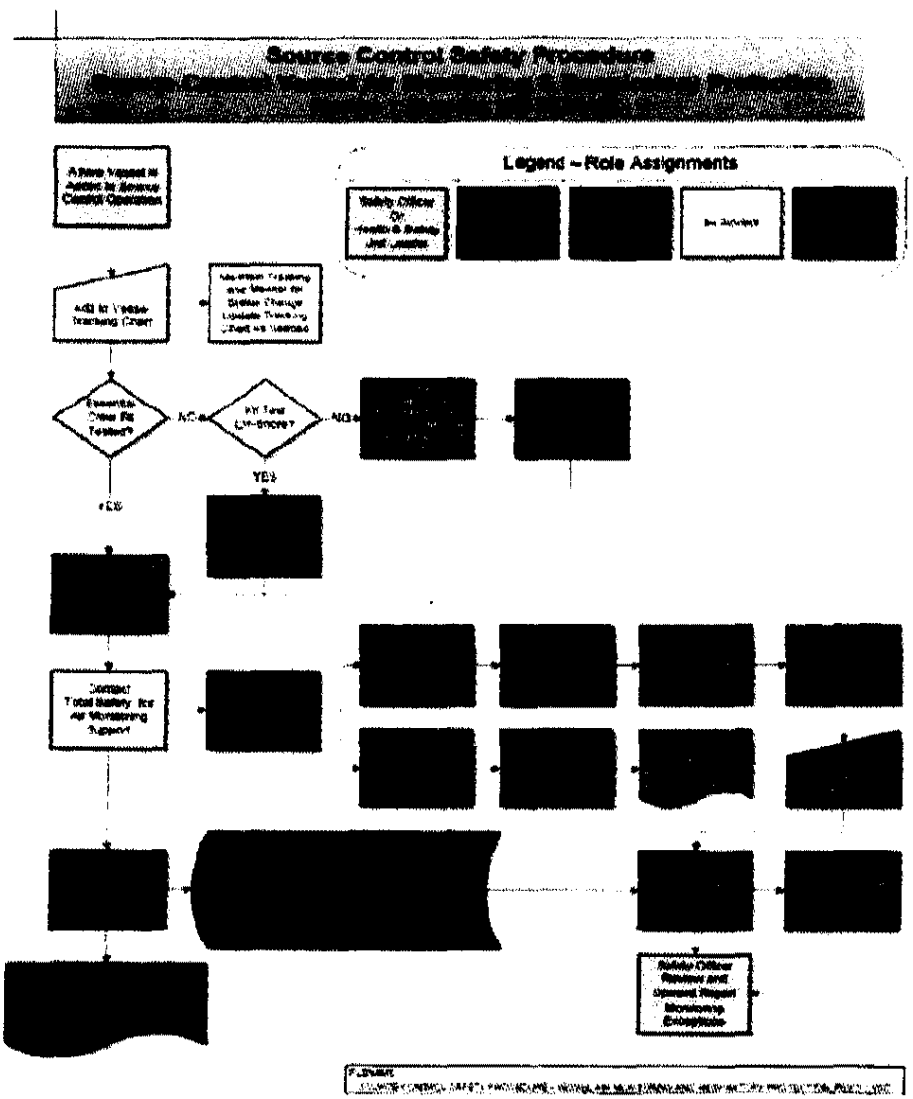
Attachment 1



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Authority:	Safety Officer/Sr. Industrial Hygienist	**Revision**	5
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Security Classification:	Project Confidential	**Page:**	Page 19 of 21
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Document Authorization Form

This form to be used for authorizing new, revised and obsolete documents, please indicate clearly which category applies

Special Instructions	Deepwater Horizon Incident

Document Details

Document Number	2200-T2-DO-PN-4002	Revision	5
Document Title	Deepwater Horizon Response Offshore Air Monitoring Plan for Source Control		
Next Review Date			

Reason for Issue (check as applicable)	New Document	Revised Document	Obsolete Document
		X	

Document Sign Off

	Print Name	Signature	Date
Custodian/Owner	Joe Gallucci (Sr. IH)		6/11/10
Reviewer(s) (if applicable)	Roger G. Reddin		6/11/10
Authorizer	Ross Kerns/Tad Lynch (Safety Officers)		6/11/10
Document Control Use			

2020-T2-DM-FM-000002	5	Document Authorization Form
Document Number	Rev	Title

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Authority:	Safety Officer;Sr. Industrial Hygienist	Revision	5
Custodian/Owner:	Joseph Gallucci	Issue Date:	5/7/2010
Retention Code:	ACM3000	Next Review Date (if applicable):	5/3/201
Security Classification:	Project Confidential	Page:	Page 21 of 21

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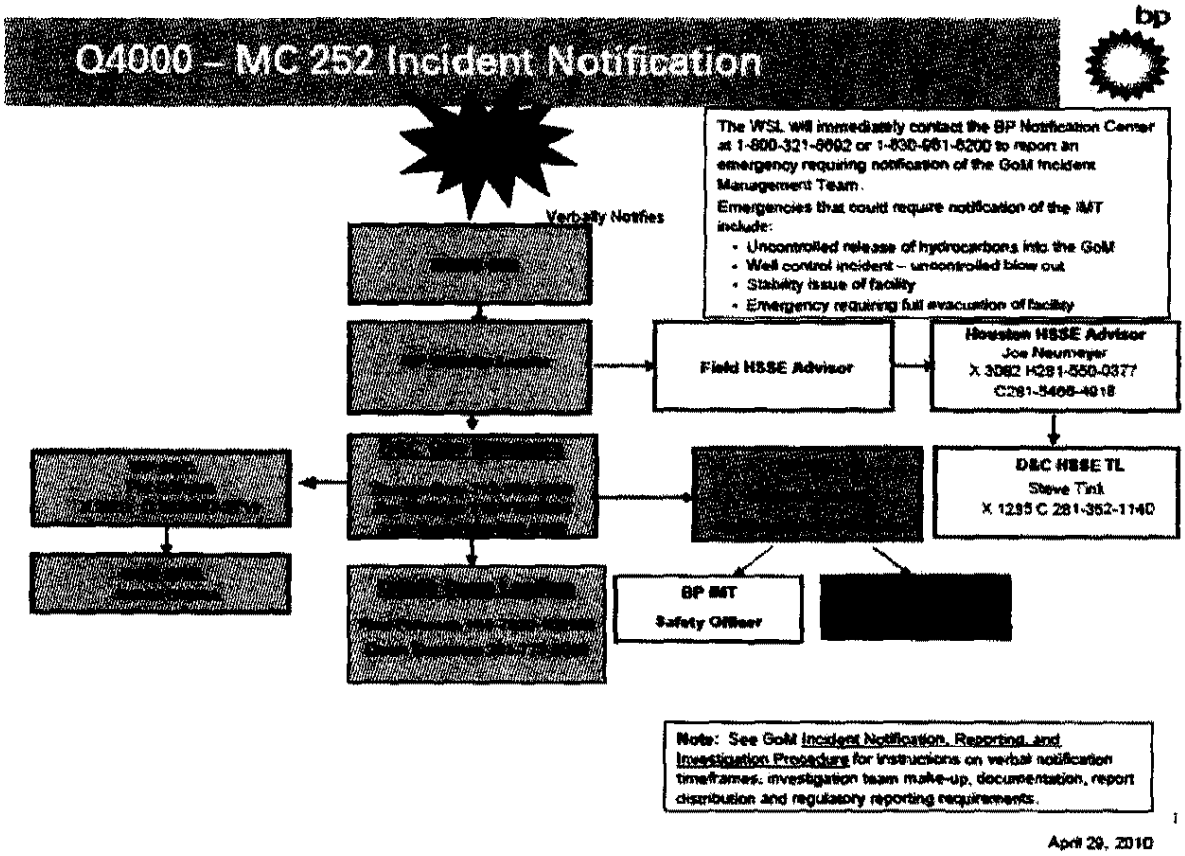
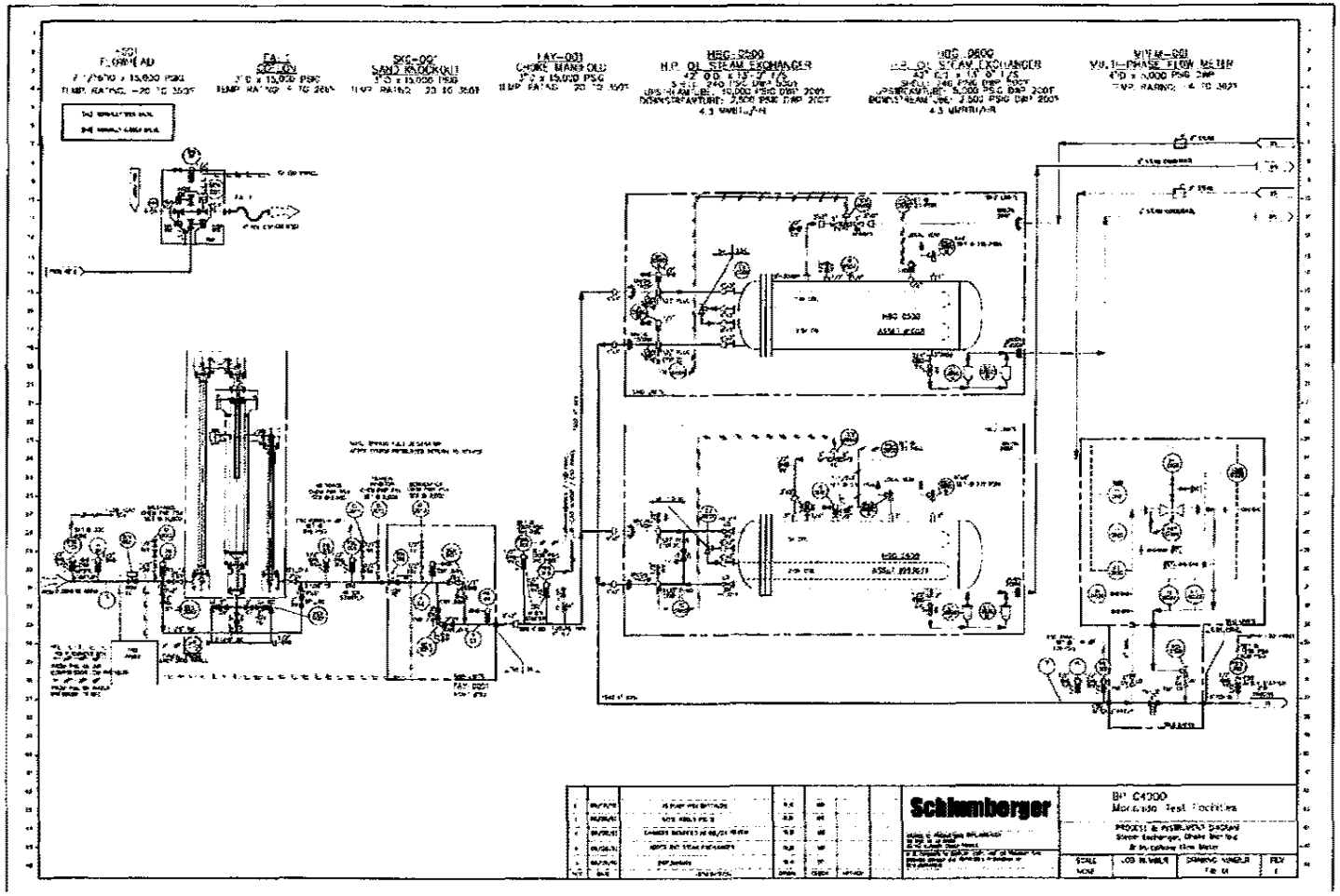
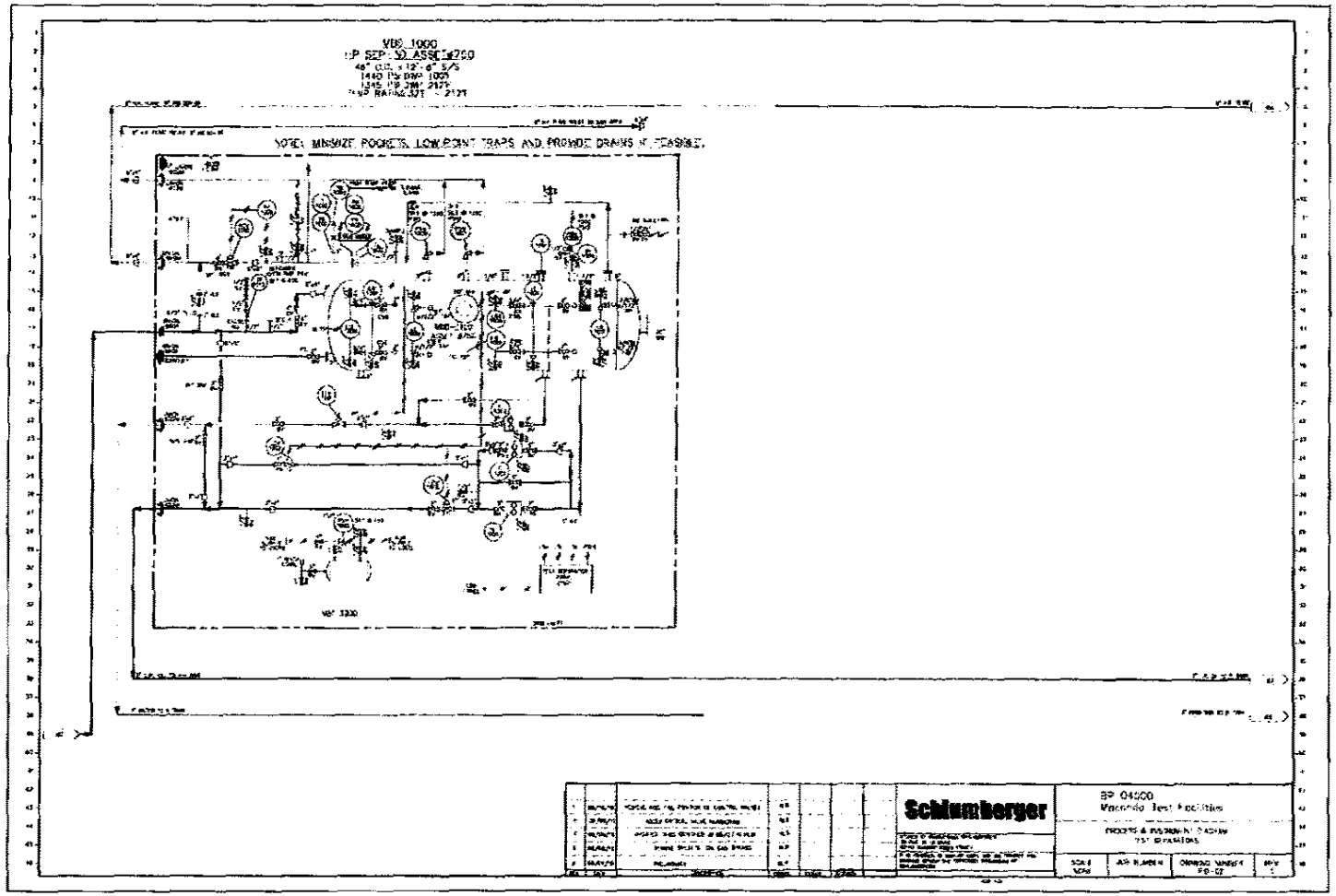
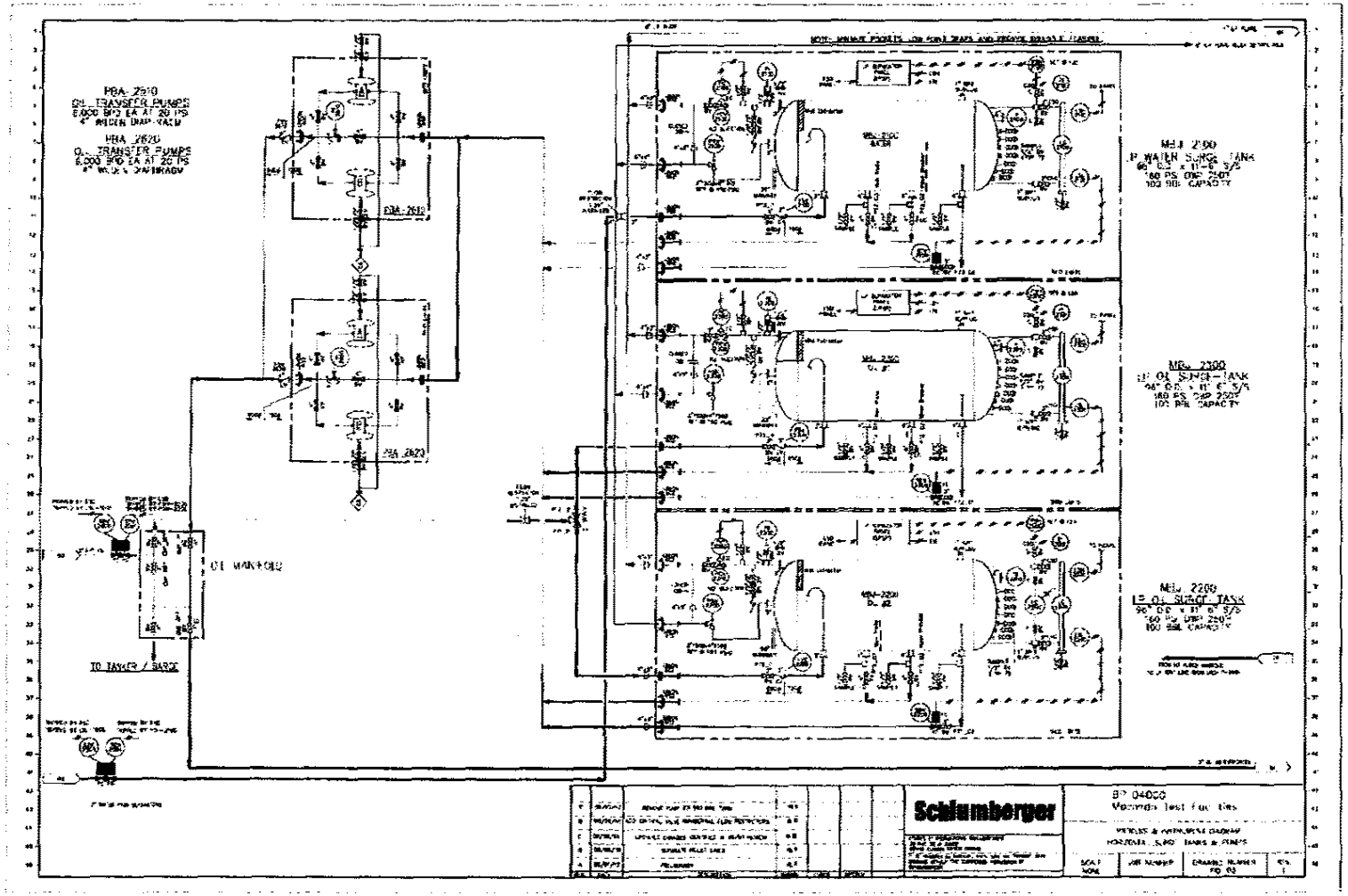
Attachment 8: Incident Notification Chart

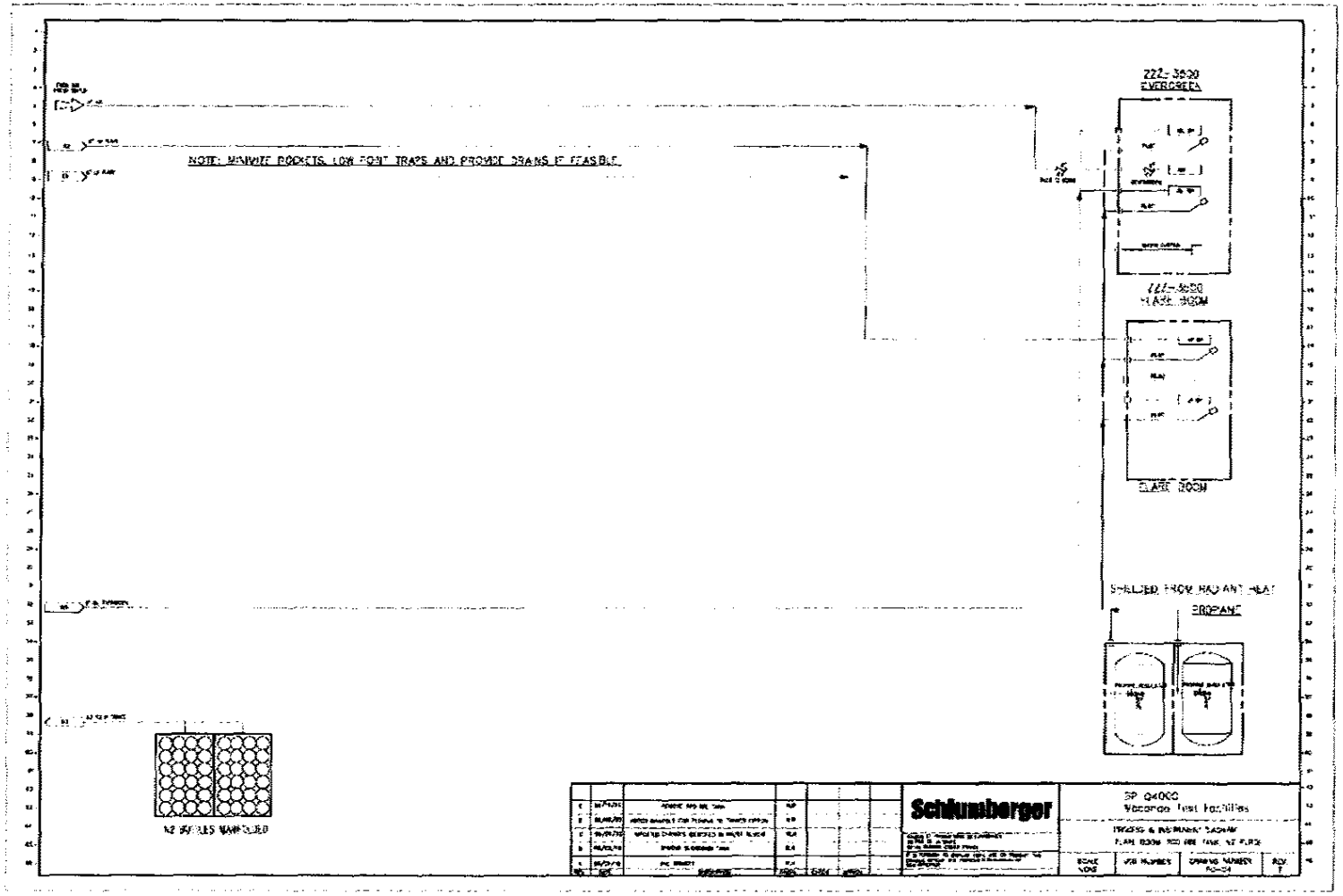


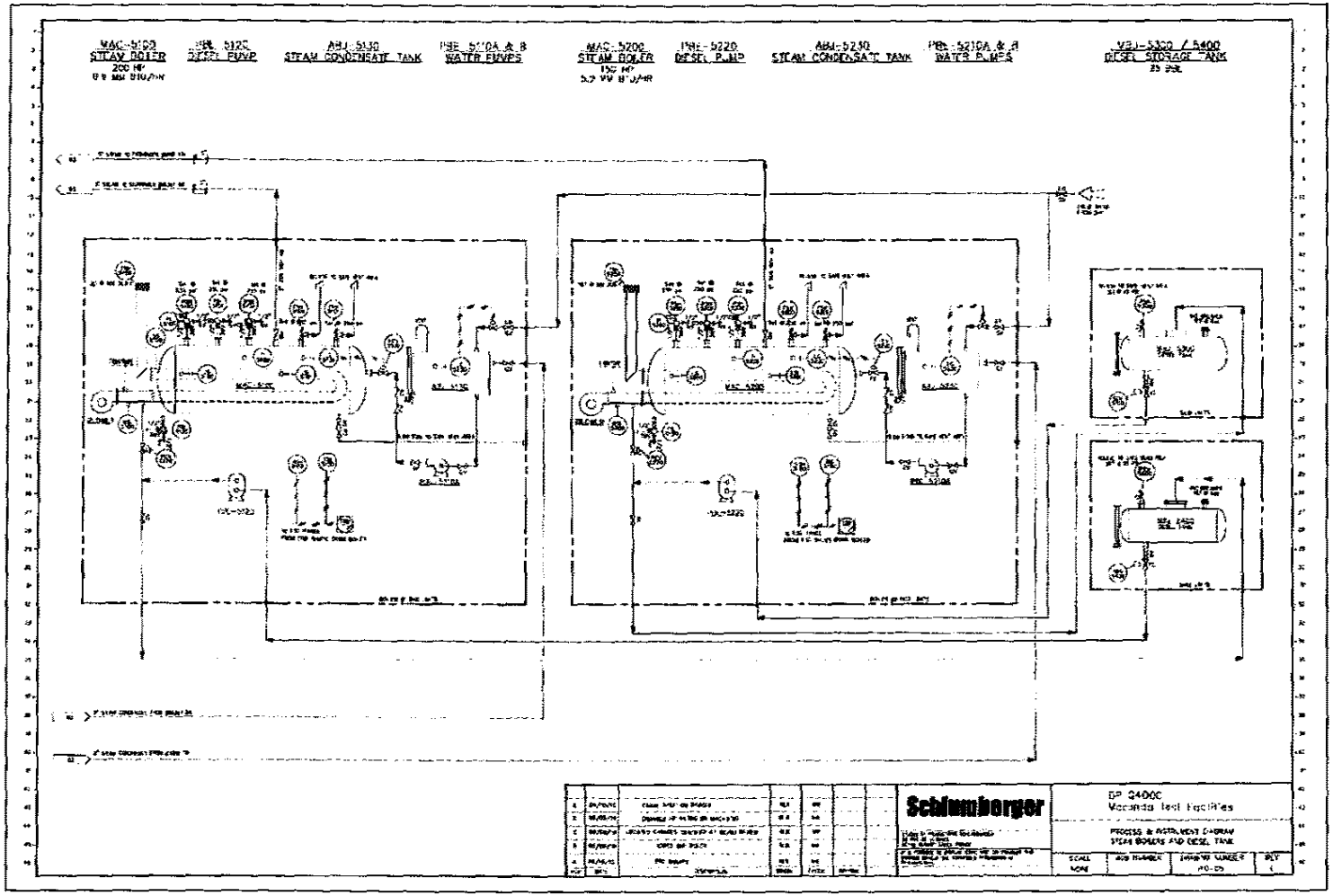
Attachment 9: P&ID Well Test Equipment




VBS_1000
NOTE: MINIMIZE POCKETS, LOW POINT TRAPS AND PROVIDE DRAINS IF FEASIBLE.
Schlumberger
BP Q4000
Mobile Test Facilities


PBA-2610
OIL TRANSFER PUMPS
6,000 BPD EA AT 20 PSI
PBA-2620
OIL TRANSFER PUMPS
6,000 BPD EA AT 20 PSI
PBA-2610
PBA-2620
OIL MANIFOLD
TO TANKER / BARGE
MEV-2200
LP OIL SURGE TANK
MEV-2300
LP OIL SURGE TANK
MEV-2400
LP WATER SURGE TANK
Schlumberger


NOTE: MINIMIZE POCKETS, LOW POINT TRAPS AND PROVIDE DRAINS IF FEASIBLE
222-3520
EVERGREEN
SHIELD FROM RADIANT HEAT
PROPANE
Schlumberger
BP Q4000
Vessels Test Facilities


MAC-5100
STEAM BOILER
200 HP
PNE-5120
DIESEL PUMP
ABU-5130
STEAM CONDENSATE TANK
PBE-5210A & B
WATER PUMPS
MAC-5200
STEAM BOILER
150 HP
PNE-5220
DIESEL P.MP
ABU-5230
STEAM CONDENSATE TANK
PBE-5210A & B
WATER P.MPS
VBU-5300 / 5400
DIESEL STORAGE TANK
Schlumberger
BP Q4000
Mocondo Test Facilities
PROCESS & INSTRUMENT DIAGRAM
STEAM BOILERS AND DIESEL TANK

Attachment 10: LDIS Operability Guide

bp

MACONDO

Containment Procedure Manual

for

MC252-1

Operability Guide for LDIS Operations

RPIC APPROVAL: Print Name above / Sign Above Date 6/6/10 Time 2345 CDT

NRMS APPROVAL: Print Name above / Sign Above Date 6/7/10 Time 18:10

Required by OSC (USCG) APPROVAL: Print Name above / Sign Above Date 6/8/10 Time 1400

0	6/6/2010	Draft	Oskar Kudla
REV	DATE	DOCUMENT STATUS	PREPARED BY
PRINT DATE	5/21/2010	Document Number	2200-T2-DO-PR-4152

AMENDMENT RECORD

Rev	Date	Author	Description	Check	Approved
0	6/4/2010	Oskar Kudla / Bobby Smith	Issued for Use		

TABLE OF CONTENTS

1 Operability Guide for LDIS Operations

1.1. Executive Summary

LDIS will be deployed from the Q4000 intervention vessel to connect a single, 1,450-ft coflon hose to a previously deployed manifold. Following connection the LDIS will be utilized to flow back hydrocarbons to the Q4000 from a BOP choke/kill line.

This operability document provides a set of guidelines to permit day-to-day connected operations only for the LDIS that utilizes 6 5/8-in drill pipe and IWOCS (Intervention Work-over Controls System). This operability document applies to flowback operation through a single 1,450-ft coflon hose LDIS system ran as per document Run LDIS with Single Coflexip Hose, 2200-T2-DO-PR-4151.

Strength analysis performed by Stress Engineering on 5/14/2010 for the 6 5/8-in S135 drill pipe string - specific for Q4000 conditions at MC252 on Q4000 - has found that the drill pipe landing string **can be deployed in conditions up to 1-year winter storm with possible deployment in 10-year winter storm** if specific conditions described in this guide are met. Ensure that there is a minimum of 4-day weather window available for the deployment of the LDIS kit. Location of the oil plume shall also be taken in account to ensure that the plume does not interfere with the Q4000 operations.

Storm fatigue analysis was not performed. However, based on similar analysis that was performed for Thunder Horse PDQ (for deployment of subsea trees on 6 5/8-in V150 drill pipe) the storm fatigue life of pipe is very high. In the short duration of this deployment, storm fatigue should be minimal.

There effectively is no loop current operability for the LDIS system. The system should not be deployed or retrieved in loop current conditions. This operability is restricted to reduced currents and reduced sea states. Based on the analysis performed by Stress Engineering on 6/2/2010, the LDIS system can be deployed and operational in 0.4-knot background current with 1.08-knot surface velocity.

1.2. Limitations

This operability document is **not a Containment procedure** that specifies detailed sequence of operations. LDIS operability guidelines document does not cover surface operation limits during containment or flowback operations, plant shutdowns, and equipment installation and retrieval procedures. In addition, this document does not cover simultaneous operations (SIMOPs) between vessels and vessel specific operating criteria.

1.3. Scope

This operability document provides a set of guidelines to permit day-to-day connected operation for the LDIS that utilizes 6 5/8-in drill pipe, and IWOCS (Intervention Work-over Controls System). The operability guideline and Shutdown document, Q4000 Containment LDIS Shutdown Requirements 2200-T2-DO-PR-4174, should be used concurrently with the actual operational procedures.

1.4. Operability Limits Based on Sea State

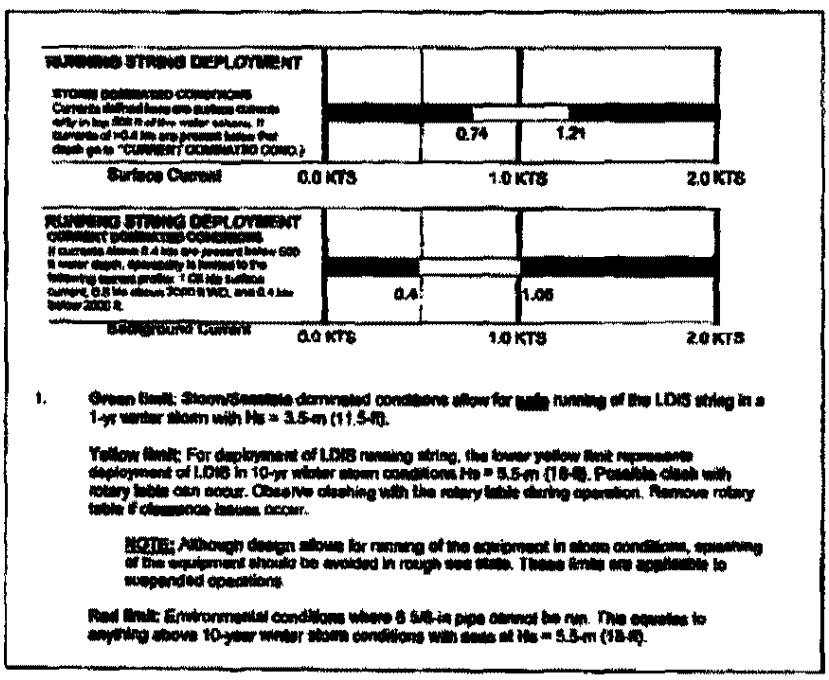
The allowable sea state conditions, (Figure 1) are based on the analysis performed by Stress Engineering, specifically for LDIS deployment off the Q4000 for top Kill Operations. These conditions are applicable to the containment operations because the system for this containment operation is very similar to the top kill system, but with lighter production fluids, and one Coflexip hose removed. However, if the Q4000 MC252 team believes that the operations require better conditions than the ones specified below, then deployment shall not be performed until it can be completed safely.

Open Water LDIS operations shall not be performed when the loop current is on site. The LDIS does not have fatigue life to be deployed / retrieved when the loop current is present. When the loop current is within 10-miles of site and progressing towards the location where the Q4000 is operating, a current monitoring boat shall be considered to determine the movement of the loop current.

Even though loop current operability is not allowed, some limited operability is present in certain current conditions as defined in Figure 1.The LDIS has a significant fatigue life in background currents of 0.4-knots. The fatigue life for continuous operation in background currents of 0.8-knots is in less than 1-week, so extended periods of exposure at this current velocity must be avoided. Consult with Houston on current velocity concerns.

For monitoring current at the location, ADCP data obtained from DDII *rig* (also located at MC252) should be used. The information from DDII ADCP can be obtained from NOAA website at the following link:

http://www.ndbc.noaa.gov/station_page.php?station=42916. If the loop current is present, the subsea equipment should not be splashed.



1. Green limit: Storm/Seastate dominated conditions allow for safe running of the LDIS string in a 1-yr winter storm with Hs = 3.5-m (11.5-ft).

   Yellow limit: For deployment of LDIS running string, the lower yellow limit represents deployment of LDIS in 10-yr winter storm conditions Hs = 5.5-m (18-ft). Possible clash with rotary table can occur. Observe clashing with the rotary table during operation. Remove rotary table if clearance issues occur.

   NOTE: Although design allows for running of the equipment in storm conditions, operating of the equipment should be avoided in rough sea state. These limits are applicable to suspended operations.

   Red limit: Environmental conditions where 6 5/8-in pipe cannot be run. This equates to anything above 10-year winter storm conditions with seas at Hs = 5.5-m (18-ft).

Figure 1: Operability Limits

1.5. Deployment, Retrieval, and Operation of LDIS

Detailed procedures for deployment, operation during flowback and retrieval of the LDIS are included in the operation procedures **MC252 Containment**. This document provides information regarding some key operational points:

- Prior to deployment of the LDIS, BP operation engineer or the subsea advisor will ensure that the existing and forecasted environmental limits and sea states are within acceptable limits for at least 4-days. This 4-day window will allow for safe deployment of the LDIS and Coflexip line. Additional days need to be added for any operation that will be performed through the system, and retrieval of the system. However these can be monitored on day by day basis.

- The LDIS has no centralization equipment - Q4000 must remain centered above the predetermined location per SIMOPS plan when connected. Refer to the latest revision of MC252-SK-1010-01 Drawing.
  - For connected operations it is imperative that the watch circle is closely monitored. Refer to Section 1.6.3.
  - For connected operations, it is imperative that the 6 5/8-in pipe does not come in contact with the rotary table.

    If the pipe contacts the side of the rotary, the loads in the pipe can exceed allowable stresses. While the pipe will not part, it can be bent. If that occurs, the bent pipe has to be replaced with another joint.
  - To mitigate for the lack of centralization, rotary table bushings shall be removed while LDIS is connected. This will provide 49 1/2-in opening at the rotary.
  - A guard rail shall be installed around open rotary to prevent possible fall hazard.
  - If additional clearance is required, rotary table may be skidded away from the wet center exposing full moonpool opening of Q4000.
- For MC252 Containment operating conditions, the LDIS shall be spaced out so that the bottom of the LRA1, at the connection to the Coflexip hose, is approximately 150 to 175-ft above mud line. This distance has been determined based on the load capacity and allowable lateral offsets of the coflon hoses.

1.5.1. Spaceout

ROV will follow the LDIS to depth. During deployment, a depth measurement shall be taken with and ROV to determine the elevation of the LRA1.

The bottom of the LRA1 be placed about 150 to 175-ft above mudline.

The surface equipment shall be spaced out to place the flowhead 15 to 20-ft above the rig floor.

1.5.2. Land out and Tensions

LDIS will not be landed out on the well for MC252 operations and no specific tensions are required. During connected operations the LDIS will be suspended on the block. A single 1,460-ft coflon will be connected to the LRA1 via a crossover joint. The other end of this hose will be connected to a subsea manifold.

1.6. Offset Envelope and Watch Circle

1.6.1. Offset Envelope

There is no practical offset allowable when the LDIS is connected to the manifold via the coflon hose. Q4000 must remain at location defined in the SIMOPs drawing.

1.8.2. *Watch Circle Information*

- Time to fully disconnect is **70-seconds** from the time the disconnect function is activated by FMC at the IWOCS reel. There is no capability to disconnect at the rig floor. As a result close communication between rig floor, bridge / DPO and the FMC reel operator is critical for connected operations. Refer to **Section 1.7.2** for details.
- Drift off calculations for Q4000 are presented in Figure 2. These drift off times were obtained from drift-off test performed by Q4000 on May 17, 2010 after it arrived at the MC 252 location.

Watch Circle calculations based on the drift off test performed by Q4000 at MC252

The calculations below show watch circles updated based on 70 sec. disconnect time of the QRC on the LDIS, and the actual drift off obtained by Q4000 at the time of arrival to the field.

Drift off data:

Time	60 sec		5/21/2010
Distance	9.4 m	30.8414 ft	O.KUDLA

Time	Distance (m)	Distance (ft)
0	0.0	0.0
5	0.8	2.6
10	1.8	6.1
15	2.4	7.7
20	3.1	10.3
25	3.9	12.9
30	4.7	15.4
35	5.5	18.0
40	6.3	20.6
45	7.1	23.1
50	7.8	25.7
55	8.6	28.3
60	9.4	30.8
65	10.2	33.4
70	11.0	36.0
75	11.8	38.6
80	12.5	41.1
85	13.3	43.7
90	14.9	48.9
100	15.7	51.4
105	16.5	54.0
110	17.2	56.5
115	18.0	59.1
120	18.8	61.7
125	19.6	64.3
130	20.4	66.8
135	21.2	69.4
140	21.9	72.0
145	22.7	74.5
150	23.5	77.1
155	24.3	79.7

Time to disconnect
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70

Figure 2: Q4000 Drift off Chart.

- Watch circle limitation comes from the maximum stretch that coflon hoses can withstand. During connected operations, watch circles are represented by a series of lights located on Q4000. The lights are activated from the bridge by the captain or the DP officer.
  - Nominal Green Watch Circle will be set at approximately 33-ft (10-m). Normal operations can continue.
  - Yellow Watch Circle will be set at 41-ft (12.5-m). This is advisory status, the crew should prepare to secure the well and get ready to perform disconnect. See **Section 1.8.2** for details on disconnect scenarios. Yellow lights require no action from the FMC reel operator with respect to disconnect or shut down. When the yellow light is actuated, the possibility of red light is likely so the operator should be prepared to disconnect the LRA1.
  - Red Watch Circle - Technip analysis shows that 82-ft (25-m) excursion from nominal location is acceptable. In a drift off situation with 70-second disconnect time, the disconnect function must be initiated at 46-ft (14-m) offset from the nominal position. Other controlled drive off scenarios need to follow the same watch circle philosophy. The specifics of those scenarios are defined in **Section 1.8.2.**

1.7. Communications

1.7.1. Vessel to Vessel

- Vessel to vessel contact is via radio communications. Channel 13 has been used for communications between vessels. Captain of the Q4000 needs to verify UHF/VHF frequency of the communications.
- All vessels are notified via radio immediately of any operational upset, vessel position change or shutdown event.
- Phone list has been developed and distributed to the Q4000 project managers and BP subsea advisors as a backup communication. It is responsibility of Q4000 captain to ensure that the backup communication philosophy has been communicated to vessels assisting in operations.

1.7.2. Operations on Q4000

- Captain shall select radio channal that will be used to conduct all communications during intervention operations. Ensure that all work areas have radio available and all radio checks are performed. Work areas include Bridge, Drill Cabin, FMC MOCS Umbilical Reel, and Flowback Manifold. Perform radio check every 30-minutes.
- Center point of communication for monitoring the watch circle will be with the Q4000 driller on the Q4000. Any operation performed will need to be channeled through the driller who will confirm that the operation may proceed.

- Driller will inform the FMC IWOCS reel operator of the status of watch circles. Driller will also give command to FMC IWOCS operator to perform **Emergency Disconnect** sequence when red watch circle is reached. Disconnect sequences are defined in **Section 1.8.** To minimize confusion and risk, the driller is the only person that can relay a DISCONNECT command to the FMC reel operator. If anyone on the rig (including DPO) is aware of an event that may lead to an emergency shutdown or disconnect, the event must be channeled to the driller.
- A system P and ID schematic will be located on the drill floor, and will be marked appropriately as the operations are ongoing. This schematic will be used to track valve positions through the system.
- All instructions communicated via radio shall be repeated by the receiving party and confirmation shall be given when the task / operation has been completed.
- Backup radios should be readily available at all times.

1.3. Operating Scenarios

1.3.1. Operating Assumptions

- Open Body pressure rating of the LDIS system is 15,000-psi.

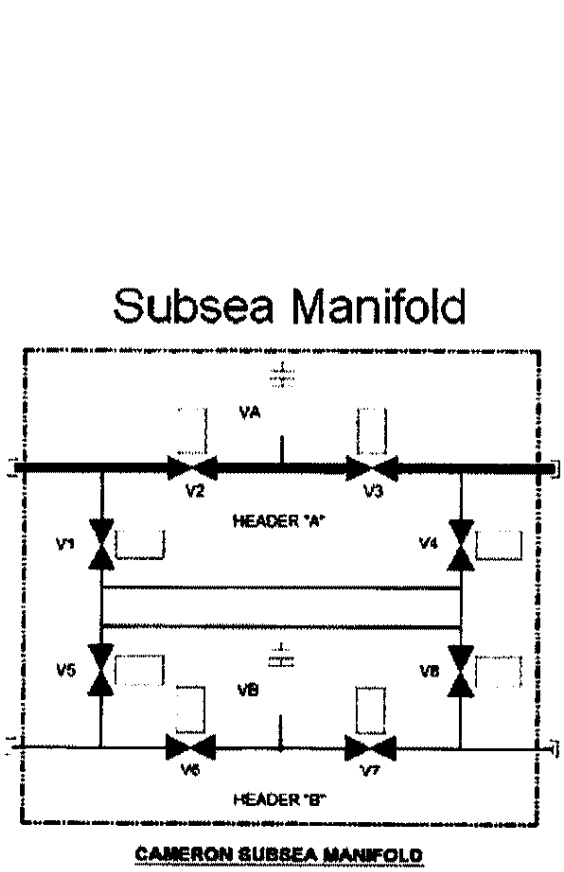
Note 1: RIV (LDIS Ball Valve) bore can only withstand a maximum differential pressure of 12,500-psi from above.

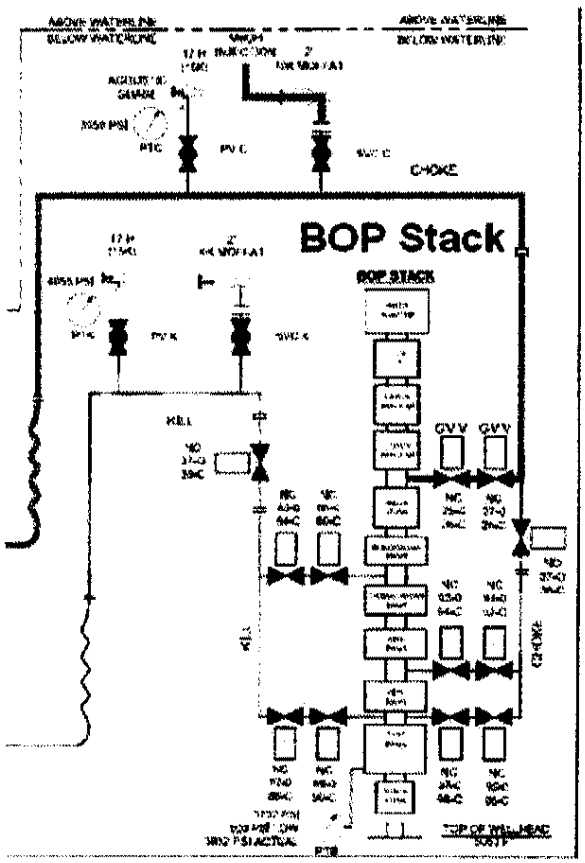
Note 2: For the Containment operations the system will only be operated at maximum pressure of 10,000-psi.

- Standard flowback will occur through only one side of BOP at any time (C or K). The flowback may alternate between both sides.
- When a shutdown of the flowback operations is required, care must be taken to prevent the coflon hose from seeing a higher external pressure (seawater gradient) than internal. This situation can happen if:
  - The BOP or manifold valves are closed and...
  - The surface pressure is allowed to bleed down and...
  - Hydrocarbons are in the coflon.
  - Plant shutdown procedures should be composed with this in mind.
- Refer to ROV monitoring document to determine the location of ROVs monitoring the well site. Minimum required monitoring includes the following:
  - Provide visual of connections/valves status at BOP. **(*)**
  - Monitor manifold connections - inspecting lines/connections. **(*)**
  - Manifold valve controls. **(*)**
  - Monitor the 1,450-ft coflon hose touchdown point.
  - Inspect coflon hoses and LDIS equipment every 12-hours during flowback operations. With no flowback is occurring, the inspection will occur every 24-hours.
  - Inspect 6-5/8-in riser and attached umbilical every 24-hours.
  - **(*)These functions can not be provided by the Q4000 due to ROV excursion limits.**

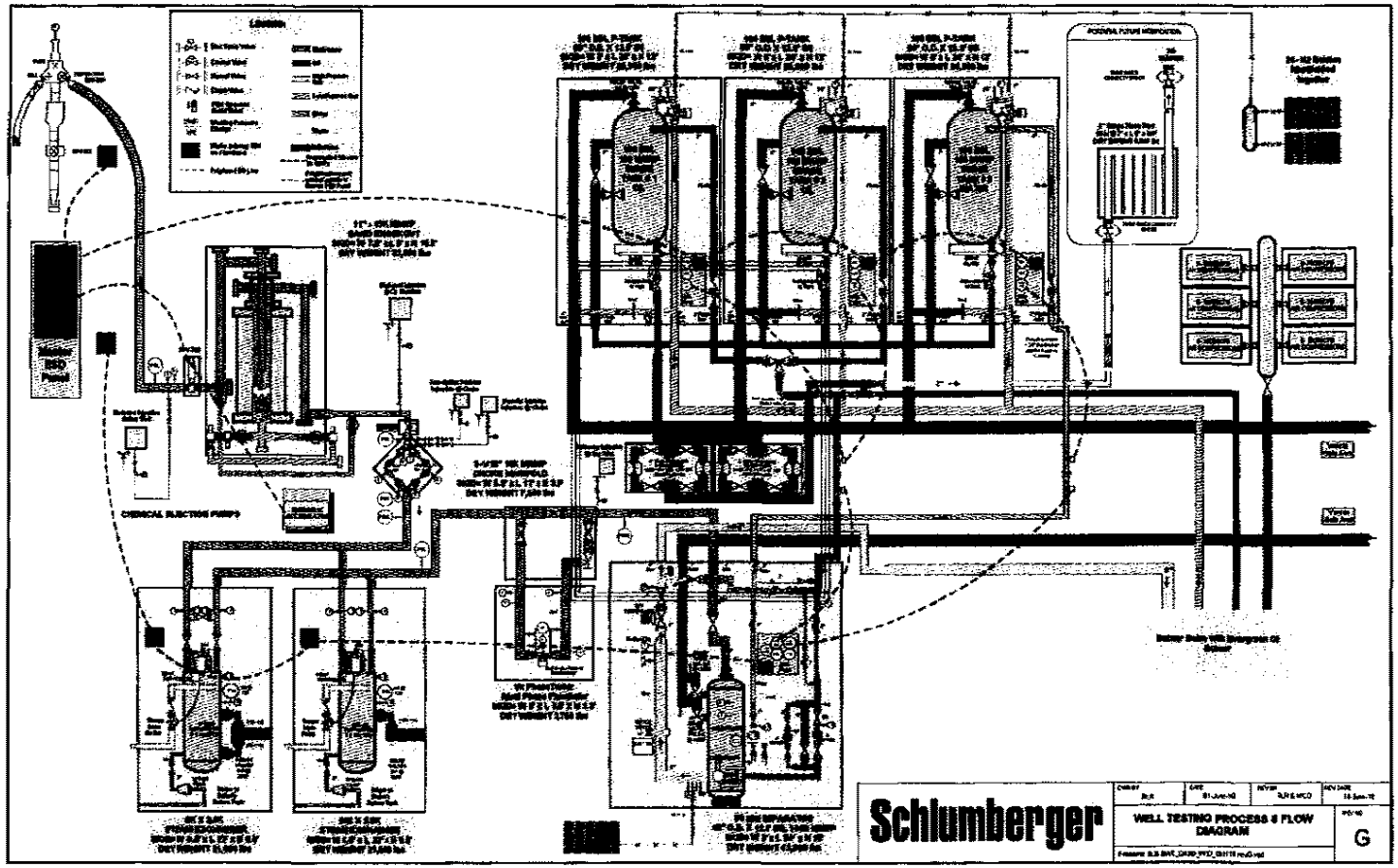
- LDIS Operation:
  - Capability to close the ball valve (RIV) on the LRA1 by utilizing IWOCS Reel Panel. This panel will be manned 24-hours a day. Time to closure after initiation - less than 10-seconds.
  - Two (2) FMC personnel shall be monitoring the reel during each shift.
  - Capability to close the ball valve (RIV) on the LRA1 and disconnect the LRA2 Connector (QRC) by utilizing the IWOCS Reel Panel. This panel will be manned 24-hours a day. Time to close the valve and release QRC is 70-seconds.
  - Position of LDIS from seafloor will provide 82-ft (25-m) of offset prior to damage to the coflon hose.
  - Supply pressure from the HPU and gauges displaying the close (gauge F2) and open (gauge B9) pressures to the ball valve (RIV) shall be monitored by FMC at the reel during all connected operations to ensure that the system is capable to close the ball valve in case of emergency shut down.
- BOP POD / MUX cable / hot line:
  - BOP is operated from the PETU on the Q4000.
  - Once the LDIS system and the 1,450 ft Coflexip hose are connected to the BOP, the guillotine for the MUX cable / hot line needs to be armed to allow for cutting of the MUX cable in case of vessel drive off or emergency departure from the field.
- Weather:
  - Commencement of the LDIS deployment requires a minimum of four (4) days of acceptable weather as defined in **Section 1.3**.
  - During connected operations five (5) day forecast needs to be monitored to ensure that weather conditions stay within allowable operating limits. A scheduled disconnect of 1,450-ft jumpers at the manifold can be performed within 60-hours. BOP pod can be retrieved to secure location only after Enterprise leaves Well location. With enterprise gone, recovery of pod can occur in 24-hours. An alternate scenario involves cutting the MUX / HOT Line at the pod.
  - Oil plume surface location needs to be monitored. If the oil plume surfaces at the Q4000 location and if the decision is made to cease operations, a 60-hour window is required to disconnect the 1,450-ft jumpers (at the manifold end) and the 24-hour window is required to retrieve BOP pod and move away from the location. An alternate plan involves quick disconnect.
  - Heading of the Q4000 will be dictated by wind direction to ensure flaring of hydrocarbons is done downwind.
- SIMOPs plan needs to be in place prior to commencement of operations. The SIMOPs plan will include exact position of the Q4000 during all operations.

Attachment 11: Subsea Manifold and BOP Stack





Attachment 12: Schlumberger Well Test Process Flow Diagram



Attachment 13: Critical Isolation Requirements

bp

MC252-1

Q-4000

CRITICAL ISOLATION REQUIREMENTS

B	6/10/2010	Draft	Joe Melvan
REV	DATE	DOCUMENT STATUS	PREPARED BY
		Doc #	N/A
PRINT DATE	11-Jun-10	FILE NAME	Attachment 17-Q4000 Critical Isolation Document

SPU	MC252-1 Q4000 Containment Procedure Q-4000 Critical Isolation Document	bp

AMENDMENT RECORD

Rev	Date	Author	Description	Sec	Page
A	6/8/2010	Joe Melvan	Draft		
B	6/10/2010	Joe Melvan	Draft: Bonnie formatted	All	All
C	6/11/2010	Joe Melvan	Changes Post Team Review	All	All

SPU	MC252-1 Q4000 Containment Procedure Q-4000 Critical Isolation Document	bp

TABLE OF CONTENTS

SPU | MC252-1 Q4000 Containment Procedure Q-4000 Critical Isolation Document | bp

1 Q4000 Critical Isolation Document

1.1 Introduction and Scope

Production from the LMRP Cap is being captured by the Enterprise. The Q4000's role is to extract a portion of the excess production that the Enterprise cannot take onboard while operating within the parameters of the LMRP Cap system, ultimately reducing hydrocarbons released at the Cap.

Production taken from the subsea stack choke line will be processed on the Helix Q4000 rig. This document summarizes the critical isolation points for the Q-4000 during flow back operations.

The scope of this document is:

- Summarize the Q-4000 flow back operation
- Identify the Critical Isolation Points along the flowpath
- Identify which rig (Q-4000 or Enterprise) controls this isolation
- Provide Command and Control schematic for critical isolation

1.2 Q-4000 Flow back

Flow back to the Q-4000 is summarized below:

- Flow is taken from the top of the Horizon BOP from Gas Vent Valve (GVV) located on the Choke line.
- From the GVV flow is taken down the 3-in ID Coflon flexible steel hose to the Junk Shot Manifold (JSM) Side "A".
- From the JSM the flow is taken to the 1,450 Coflon flexible steel hose to the LDIC/Drill Pipe.
- Flow then goes through the LDIC and 6 5/8-in drill pipe to the to the rig floor of the Q-4000 where the flow head is located. From the surface flow head the flow is taken to a standard series of surface test equipment including: HP sand knockout, choke manifold, HP heater, Multi-phase tester, HP separator, water/oil/gas surge tanks, and finally to the burner boom. See Attachment 4: Q4000 Well Test Equip Deck Layout for a complete schematic of flow equipment planned.
- Methanol will be injected for hydrate inhibition into the end of the goose neck attached to the choke line of the Horizon BOP via an umbilical attached to the Enterprise flow back architecture. The rate of methanol injection is estimated to be 4 to 5-gpm. This injection will be controlled by the Enterprise. The volume of methanol injection will be sufficient to hydrate inhibit a small amount of sea water or produced water.

The test equipment planned for the Q-4000 deck is limited by its burning capability of approximately 9,000-boed of high GOR oil. The facilities themselves are capable of processing approximately 12,000-boepd.

Under optimized flowback conditions, the Enterprise would process about 15,000-boepd and the Q-4000 would process up to 7000-9000 boepd from the remaining oil plume from the Horizon BOP. A minimal amount of oil venting to the sea will be required to prevent gross sea water production by either the Enterprise or the Q-4000 due to the hydrate issues discussed in this section.

1.3 Critical Isolation Points

Oil and gas production can be isolated from the Q-4000 in several points of the flow stream as indicated below:

1.3.1. *Subsea Isolations:*

- Gas Vent Valves (GVV) located on the Horizon BOP stack. The GVV can be commanded closed by the Q-4000 via a mux line running back to the Q-4000 from the yellow pod on the Horizon BOP.
- ROV-Operated Isolation valves on the JSM. The JSM valves can be operated by the Q-4000 Venom ROV. Operation is manual, and requires manipulation of both the supply panel and valve panel routing valves by the ROV. In addition to the Q-4000 ROV, other ROV's in the field can be used to operate the JSM valves. Operating one of these JSM valves takes several minutes once a ROV is at the manifold.
- Isolation ball valve (RIV) on the LDIC located on the bottom of the drill pipe flow string. The RIV ball valve can be commanded closed via the LDIC umbilical strapped to the side of the 6 5/8-in drill string. The valve is actuated manually at the LDIC umbilical reel.

1.3.2. *Surface Isolations*

- Flow Head Master Valve and Wing Valve (SDV-001). The master valve and wing valve can be commanded closed at the hydraulic control panel located on the rig floor. In addition, the Wing Valve (SDV-001) will be closed if any of the 28 Emergency Shut Down (ESD) stations are activated.
- HP Sand Knockout inlet shut-in valve (SDV-002). The HP sand knockout isolation valve (SDV-002) will be closed if any of the 28 ESD stations are activated. It can also be closed individually at the hydraulic control panel. It can also be closed individually at the hydraulic control panel.
- Choke inlet shut-in valve (SDV-003). The choke isolation valve (SDV-003) will be closed if any of the 28 ESD stations are activated.
- In additional to the 28 ESD valves, manual valves are located on each piece of surface flow equipment to isolate it if required, with the exception of the steam heat exchangers. Manual valves will be utilized for any planned shut in of production.

1.4 Critical Isolation Scenarios

Critical valve isolations are required for the following scenarios…

- Any loss of hydrocarbon containment at surface which could endanger personnel
- Subsea loss of containment which could result in ingress of sea water into the system and form hydrates
- Shut in of production due to the malfunction of flow process equipment

SPU | MC252-1 Q4000 Containment Procedure Q-4000 Critical Isolation Document | bp

- Shut in of production due to adverse surface conditions of wind direction or LEL readings
- Loss of station-keeping ability by the Q-4000 requiring disconnection of the flow string from the subsea architecture. This would include loss of station-keeping ability of any vessel that poses a collision threat to the Q-4000.
- Shut in of production due to the loss of methanol injection by the Enterprise into the Q-4000 subsea architecture. This would include the scenario of loss of station-keeping ability by the Enterprise.
- Any planned long term shut in including evacuation for tropical storm or Hurricane.

The flowback procedures list in detail the sequencing of valve shut in for various planned and unplanned disruptions in flow back operations.

- Figure 8 shows the valve configurations for the most likely short term shut in scenario
- Figure 10 shows the valve configurations after flushing the subsea lines back to the Horizon BOP with hydrate inhibitive fluid for a long term shut in scenario. A long term shut down is classified as any shut in which would exceed 6-hours.
- Figure 9 shows the valve configuration after an unplanned emergency disconnect. Non-critical valve closures after standard process blow-down operations are not shown.
- Document 4174 "Containment Shut Down Requirements" shows the isolation steps for a variety of events during flow back operations, including which events require disconnection from the subsea flow lines.

1.5. Isolation Command and Control

Document 4174 "Containment Shut Down Requirements" summarizes the Critical Isolations during specific events during Q-4000 flow back. In all cases, the **tour driller** will give the order for the action, with the exception of any emergency shut down activated from one of the 28 ESD stations by the observer.

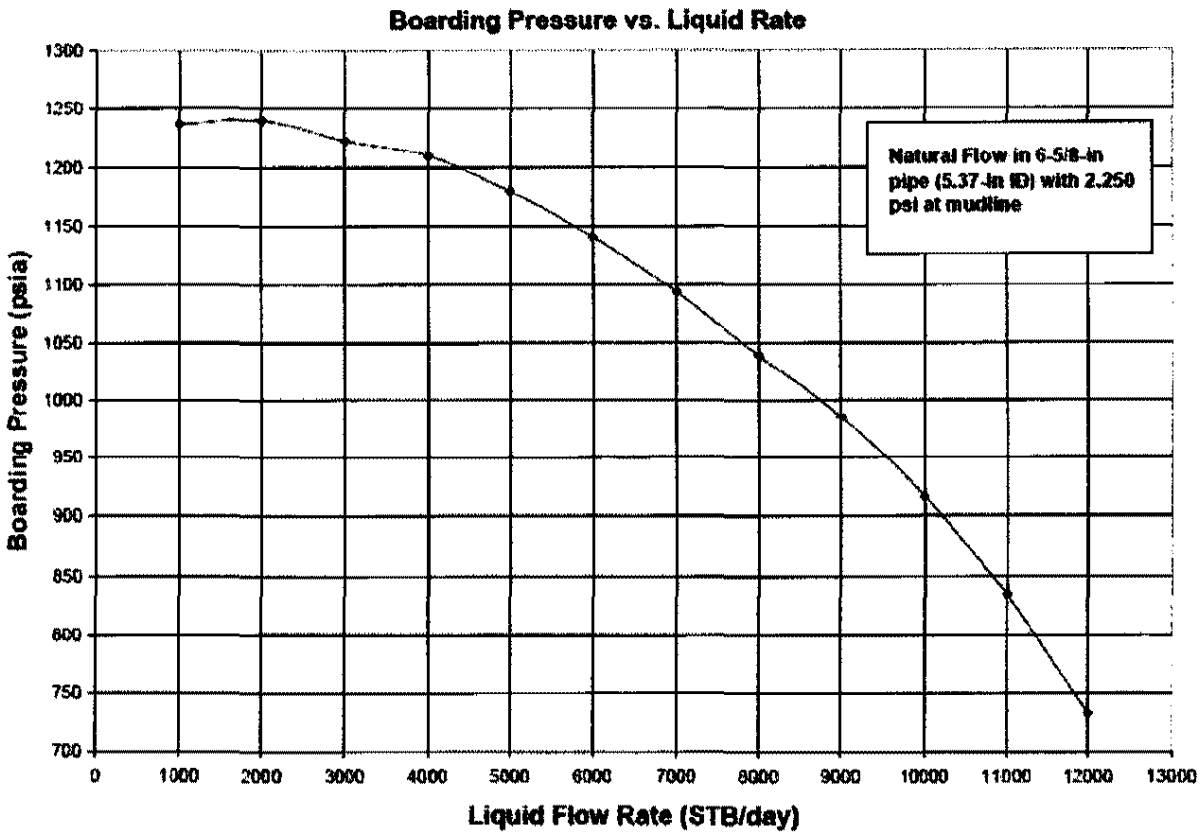
Execution of Isolation

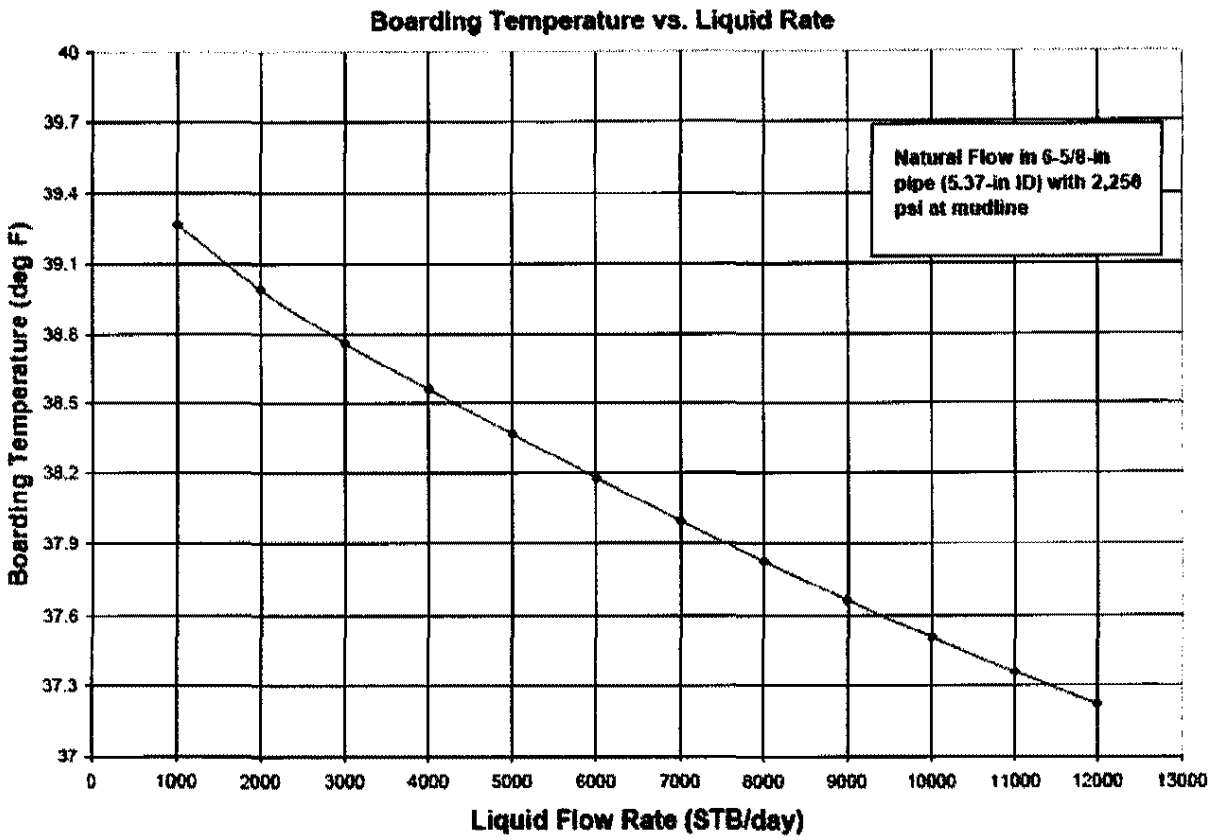
Activation of critical valve isolations is performed by several work groups within the test spread with the exception of the 28 ESD stations which should be activated by anyone who observes a loss of containment. Additional isolations called out in the flowback procedures are performed by the following work groups:

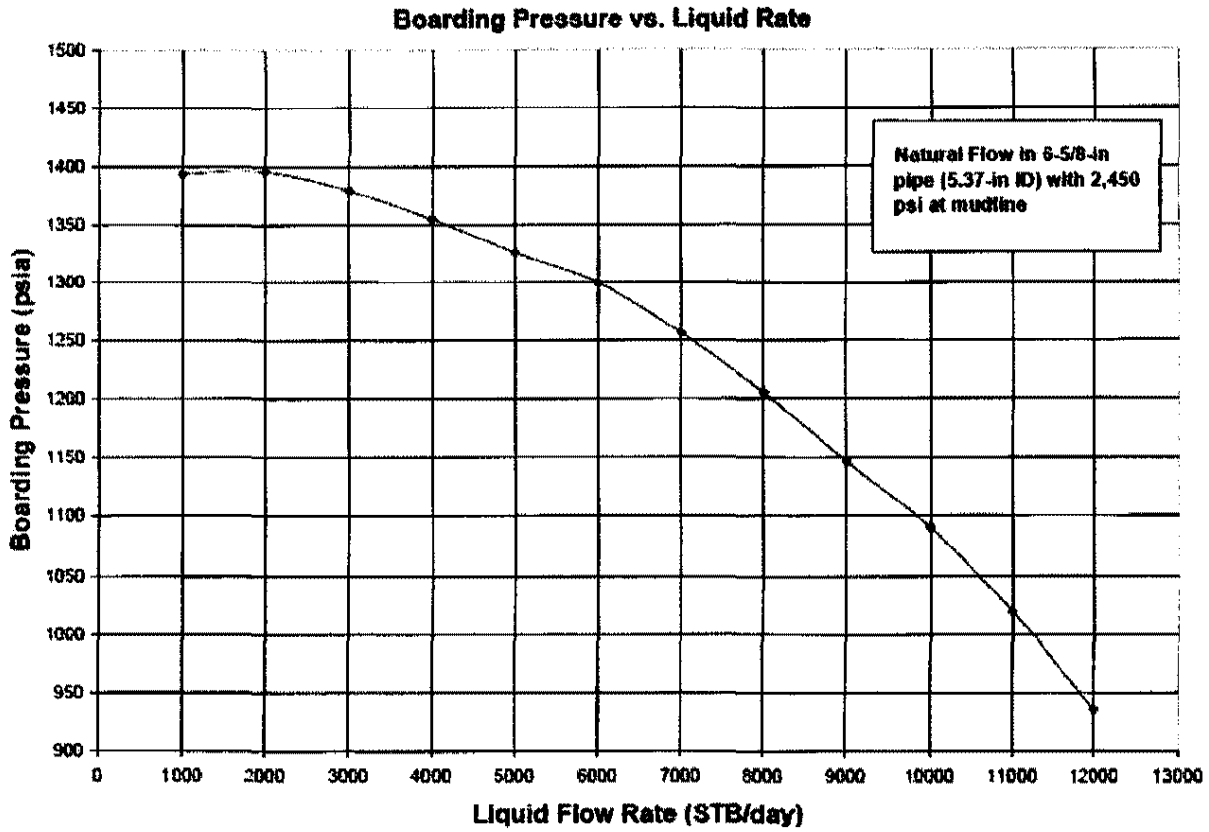
Individual action of SDV-001, 002, 003	Schlumberger Well Testers
Flow Head Valves	Schlumberger Well Testers
Manual valves on test equipment spread	Schlumberger Well Testers
RIV Isolation Valve in the LDIS	FMC Technician at Umbilical Reel
JSM Valves	Venom ROV on Q-4000
Gas Vent Valve (GVV) on Horizon BOP	Cameron Controls Group on Q-4000

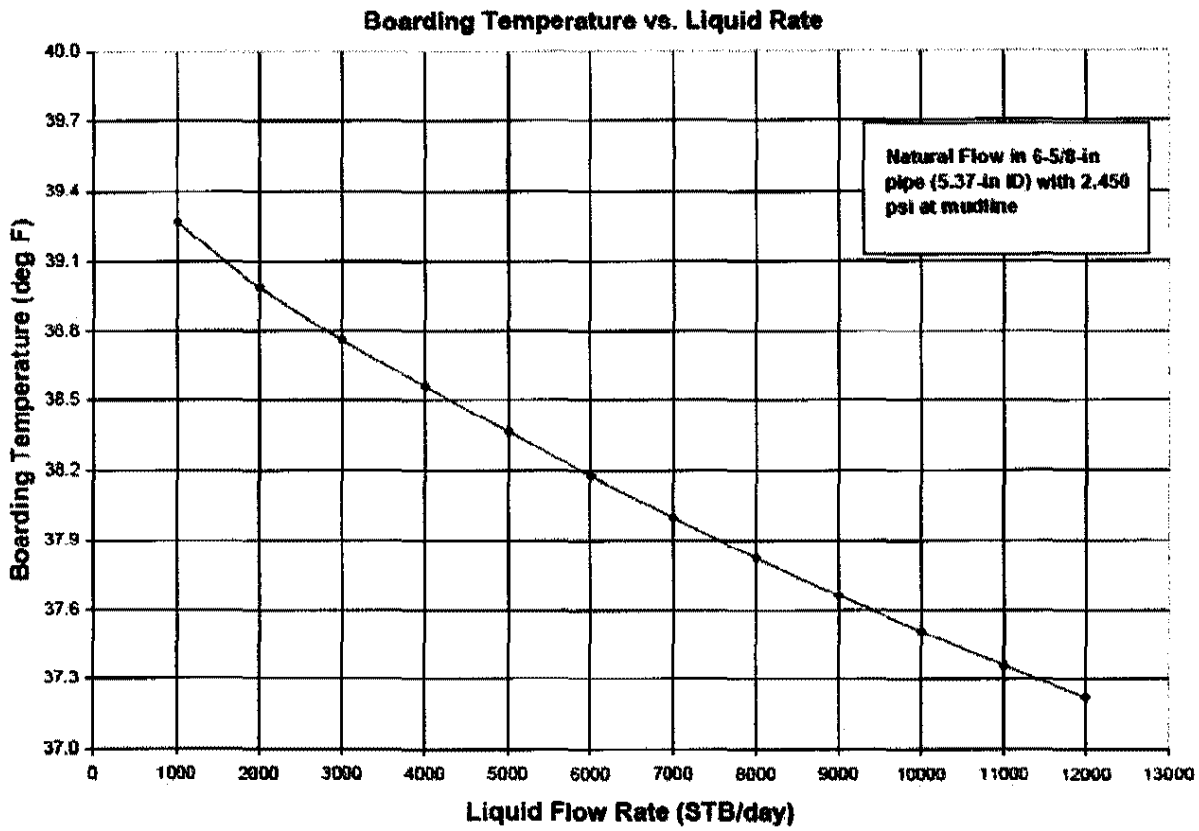
Note: Operation of JSM valves can also be operated by the Enterprise ROV or other vessels with ROV capability that are within range.

Attachment 14: Boarding Pressure vs. Flowrate Curves

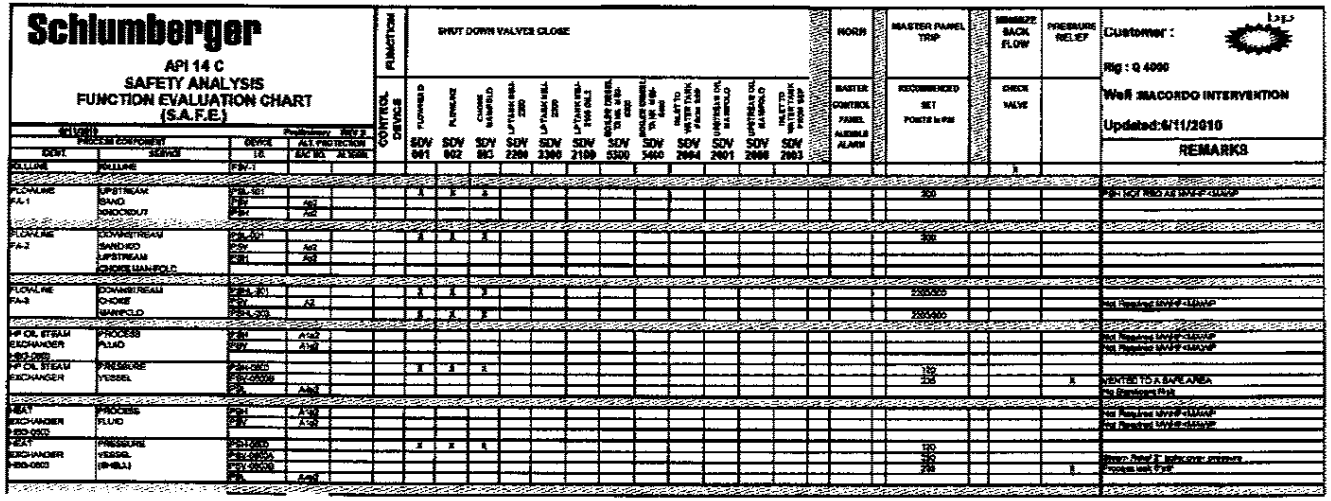



Boarding Temperature vs. Liquid Rate
Natural Flow in 6-5/8-in pipe (5.37-in ID) with 2,256 psi at mudline
Boarding Temperature (deg F)
40
39.7
39.4
39.1
38.8
38.5
38.2
37.9
37.6
37.3
37
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
Liquid Flow Rate (STB/day)


Boarding Pressure vs. Liquid Rate
Natural Flow in 6-5/8-in pipe (5.37-in ID) with 2,450 psi at mudline
Boarding Pressure (psia)
1500
1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
Liquid Flow Rate (STB/day)


Boarding Temperature vs. Liquid Rate
Boarding Temperature (deg F)
40.0
39.7
39.4
39.1
38.8
38.5
38.2
37.9
37.6
37.3
37.0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
Liquid Flow Rate (STB/day)
Natural Flow in 6-5/8-in pipe (5.37-in ID) with 2,450 psi at mudline

Attachment 15: Safe Charts (Cause and Effect)



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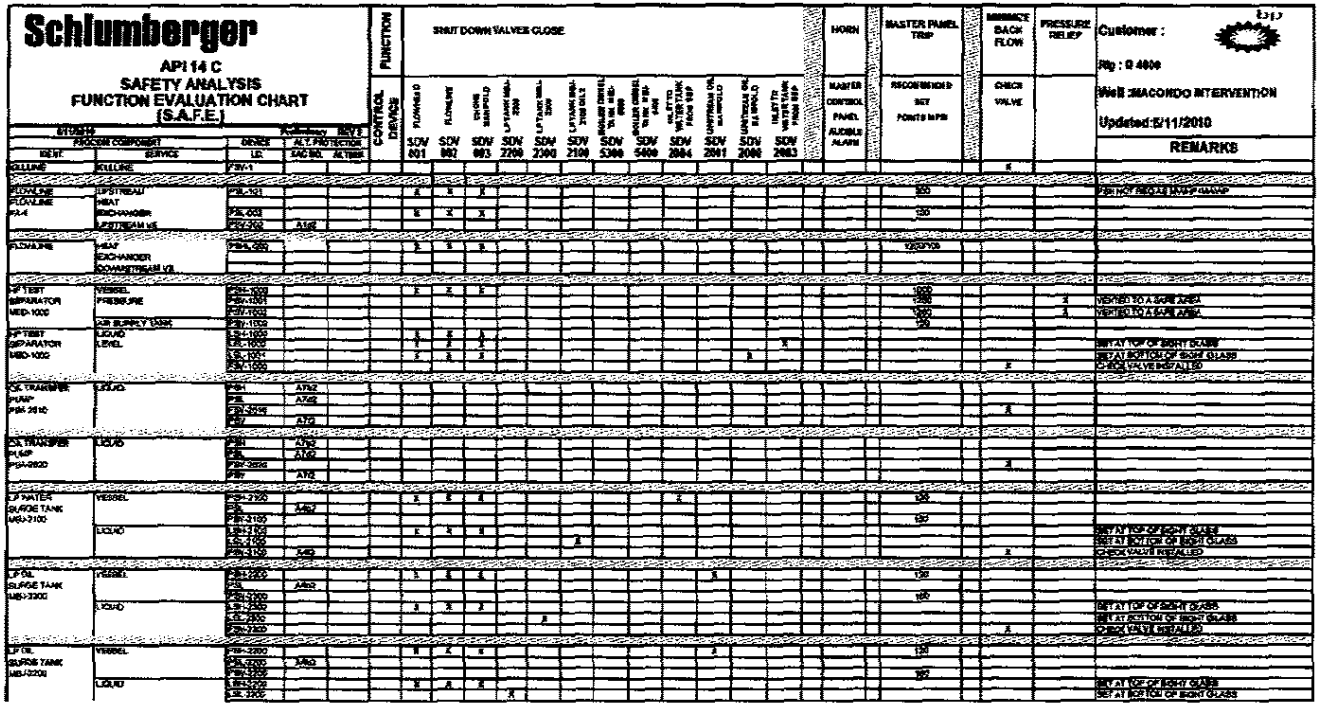
API 14 C
SAFETY ANALYSIS
FUNCTION EVALUATION CHART
(S.A.F.E.)

Customer :
Rig : Q 4000
Well :MACONDO INTERVENTION
Updated:6/11/2010

PROCESS EQUIPMENT IDENT	PROCESS EQUIPMENT SERVICE	DEVICE I.D.	ALT. PROTECTION API 14C	ALT. PROTECTION API 14H	FUNCTION: SHUT DOWN VALVES CLOSE — CONTROL DEVICE: FLOWHEAD SDV 001	FLOWLINE SDV 002	CHOKE MANIFOLD SDV 003	UPSTREAM SSV 2200	UPSTREAM SSV 2300	UPSTREAM SSV 2100	RISER CIRCUIT TOP SSV 5300	RISER CIRCUIT BTM SSV 5400	MASTER TO WATER TANK From SSV 2004	UMBILICAL OIL MANIFOLD SSV 2001	UMBILICAL OIL MANIFOLD SSV 2000	INLET TO WATER TANK From SSV 2003	NOISE: AUDIBLE ALARM	MASTER PANEL TRIP: MASTER CONTROL PANEL — RECOMMENDED SET POINTS in PSI	MINIMIZE BACK FLOW: CHECK VALVE	PRESSURE RELIEF	REMARKS
KILLLINE	KILLLINE	FSV-1																			
FLOWLINE FA-1	UPSTREAM MANIFOLD	PSL-001			X	X	X											300			
	SAND	SDV	A#2																		
	MANIFOLD	PSH	A#2																		
FLOWLINE FA-2	DOWNSTREAM CHOKE MANIFOLD	PSL-001			X	X	X											300			
	SAND	SDV	A#2																		
	UPSTREAM CHOKE MANIFOLD	PSH	A#2																		
FLOWLINE FA-3	DOWNSTREAM CHOKE MANIFOLD	PSL-001			X	X	X											2300/600			Not Required MWP=15MWP
	SAND	SDV	A2																		
		PSH-003			X	X	X											2300/600			
HP OIL STEAM EXCHANGER HEX-0002	PROCESS FLUID	PSH	A1a2																		Not Required MWP=15MWP
		SDV	A1a2																		Not Required MWP=15MWP
HP OIL STEAM EXCHANGER	PRESSURE VESSEL	PSH-0003			X	X	X											150			
		PSV-0003A																225		X	VENTED TO A SAFE AREA
		PSL	A#a2																		No Backpack Risk
HEAT EXCHANGER HEX-0003	PROCESS FLUID	PSH	A1a2																		Not Required MWP=15MWP
		SDV	A1a2																		Not Required MWP=15MWP
HEAT EXCHANGER HEX-0003	PRESSURE VESSEL (SHELL)	PSH-0003			X	X	X											150			
		PSV-0003A																225			Steam Relief & spillover pressure
		PSV-0003B																299		X	Process set 10%
		PSL	A#a2																		



Schlumberger

API 14 C
SAFETY ANALYSIS
FUNCTION EVALUATION CHART
[S.A.F.E.]

Customer :

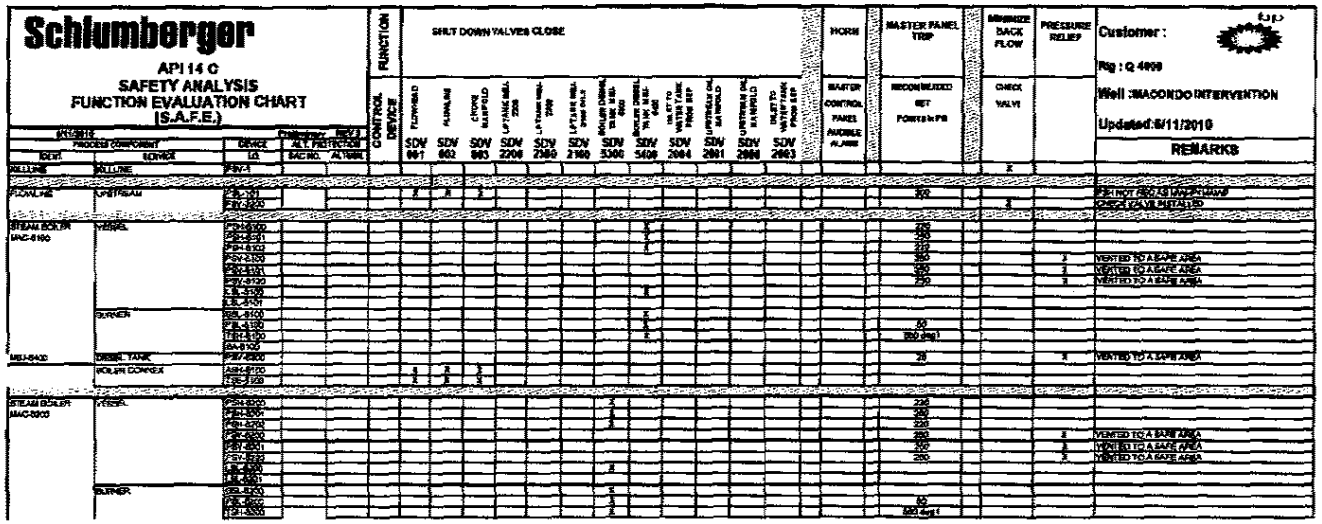
Rig : Q 4000

Well :MACONDO INTERVENTION

Updated:5/11/2010

SYSTEM / PROCESS COMPONENT / EVENT	SERVICE	DEVICE / I.D.	ALTERNATE PROTECTION / SAC NO.	ALTERNATE PROTECTION / ACTION	REV 3
FLOWLINE	FLOWLINE	FSV-1			
FLOWLINE	UPSTREAM	PSL-101			
FLOWLINE	HEAT EXCHANGER	PSL-003			
FLOWLINE	DOWNSTREAM VB	PSV-202	A16		
FLOWLINE	HEAT EXCHANGER	PSHL-201			
HP TEST SEPARATOR MSD-1000	VESSEL PRESSURE	PSH-1000			
		PSH-1001			
		PSV-1002			
	AIR SUPPLY 13095	PSH-1002			
HP TEST SEPARATOR MSD-1000	LIQUID LEVEL	LSL-1003			
		LSH-1004			
		LSL-1001			
		LSH-1005			
OIL TRANSFER PUMP PSK-2610	LIQUID	PSH	A7A2		
		PSL	A7A2		
		PSH-2610			
		PSV	A7G		
OIL TRANSFER PUMP PSK-2620	LIQUID	PSH	A7A2		
		PSL	A7A2		
		PSH-2620			
		PSV	A7G		
LP WATER SURGE TANK MSD-3100	VESSEL	PSH-3100			
		PSL	A4A7		
		PSH-3150			
	LIQUID	LSH-3104			
		LSL-3105			
		PSH-3120	A49		
LP OIL SURGE TANK MSD-3300	VESSEL	PSH-3300			
		PSL	A4A3		
		PSH-3300			
	LIQUID	LSH-3301			
		LSL-3302			
		PSH-3320			
LP OIL SURGE TANK MSD-3200	VESSEL	PSH-3200			
		PSL-3200	A4A3		
		PSH-3250			
	LIQUID	LSH-3204			
		LSL-3205			

FUNCTION	SHUT DOWN VALVES CLOSE														HORN	MASTER PANEL TRIP	MINIMIZE BACK FLOW	PRESSURE RELIEF	REMARKS
CONTROL DEVICE	FLOWLINE SDV 001	FLOWLINE SDV 002	RISING MAIN SDV 003	LP TANK MAIN SDV 2200	LP TANK MAIN SDV 3300	LP TANK RISER SDV 3100	BOOSTER PUMP SUCTION SDV 5300	BOOSTER PUMP DISCH SDV 5400	OIL TO WATER TANK SDV 2004	OVERFLOW OIL SDV 2001	UNDERFLOW OIL SDV 2000	INLET TO WATER TANK SDV 2003	MASTER CONTROL PANEL AUDIBLE ALARM	RECOMMENDED SET POINTS MPSI	CHECK VALVE		
	X	X	X													900			PSH NOT REQ'D MVP/P MANIP
	X	X	X													130			
	X	X	X													1200PSI			
	X	X	X										X			1600			
																1500		X	VENTED TO A SAFE AREA
																1000		X	VENTED TO A SAFE AREA
																150			
	X	X	X																SET AT TOP OF SIGHT GLASS
	X	X	X								X	X							SET AT BOTTOM OF SIGHT GLASS
																	X		CHECK VALVE RIP ALL 50
																	X		
																	X		
	X	X	X						X							125			
																697			
	X	X	X																SET AT TOP OF SIGHT GLASS
					X														SET AT BOTTOM OF SIGHT GLASS
																	X		CHECK VALVE RIP ALLED
	X	X	X							X						130			
																165			
	X	X	X																SET AT TOP OF SIGHT GLASS
					X														SET AT BOTTOM OF SIGHT GLASS
																	X		CHECK VALVE RIP ALLED
	X	X	X							X						130			
																997			
	X	X	X	X															SET AT TOP OF SIGHT GLASS
																			SET AT BOTTOM OF SIGHT GLASS



Schlumberger

API 14 C
SAFETY ANALYSIS
FUNCTION EVALUATION CHART
(S.A.F.E.)

FUNCTION: SHUT DOWN VALVES CLOSE

PROCESS COMPONENT IDENT.	PROCESS COMPONENT SERVICE	DEVICE ID	CONTROL DEVICE	SDV 001	SDV 002	SDV 005	SDV 2200	SDV 2300	SDV 2100	SDV 5300	SDV 5400	SDV 2004	SDV 2001	SDV 2000	SDV 2003	HORN: MASTER CONTROL PANEL AUDIBLE ALARM	MASTER PANEL TRIP: RECOMMENDED SET POINT in PSI	MINIMIZE BACK FLOW: CHECK VALVE	PRESSURE RELIEF	REMARKS
WELLLINE	WELLLINE	PSV-1																X		
FLOWLINE	UPSTREAM	PSL-1001		X	X	X											300			
		PSV-1002																X		CHECK VALVE INSTALLED
STEAM BOILER MAC-5100	VESSEL	PSH-5100									SDV 5400						225			
		PSH-5101															300			
		PSH-5102															270			
		PSV-5103															350		X	VENTED TO A SAFE AREA
		PSV-5104															350		X	VENTED TO A SAFE AREA
		PSV-5105															350		X	VENTED TO A SAFE AREA
		LSL-5106									SDV 5400									
		LSL-5107																		
	BURNER	SSL-5100																		
		FSL-5100															50			
		TSH-5100															350 deg F			
		SSV-5105																		
MUI-5400	DIESEL TANK	PSV-5000															20		X	VENTED TO A SAFE AREA
	BOILER CONSOLE	ASH-5100		Auto	Auto	Auto/Manual														
		TSH-5100																		
STEAM BOILER MAC-5600	VESSEL	PSH-5600								X							225			
		PSH-5601															300			
		PSH-5602															220			
		PSV-5603															350		X	VENTED TO A SAFE AREA
		PSV-5604															350		X	VENTED TO A SAFE AREA
		PSV-5605															350		X	VENTED TO A SAFE AREA
		LSL-5606								X										
		LSL-5607																		
	BURNER	SSL-5600																		
		FSL-5600								X							50			
		TSH-5600															350 deg F			

Schlumberger

Customer : bp

Rig : Q-4000

Well : MACONDO INTERVENTION | Job N° :

SAFETY SYSTEM PHILOSOPHY

Updated: 17 November, 04

FIRST STAGE

Well parameters (pressure, temperature and flow rates) are continuously monitored by the following :-

A) COMPUTER ACQUISITION SYSTEM (OPTIONAL)

1) Real time digital / analogue output of well parameters
2) Hi/lo settings for any well parameters giving audible/visual alarm (manual reset)

B) MECHANICAL PRESSURE/TEMPERATURE RECORDERS

1) Foxboro pressure/temperature recorder for wellhead
2) Barton pressure/temperature recorder for separator

C) MANUAL PRESSURE/TEMPERATURE MONITORING

1) Manual or electronic for pressure at wellhead.
2) Dial pressure gauges/pencil thermometers throughout the well test equipment.

DURING WELL TEST OPERATIONS, THE WELL PARAMETERS ARE CONTINUOUSLY MONITORED WITH CROSS CHECKS BETWEEN A, B AND C TO ENSURE ACCURACY.

SECOND STAGE

Emergency shut down system

A) OVERALL SYSTEM CONTROLLING FLOWHEAD ISOLATION VALVE AND FLOWLINE ISOLATION VALVE ON THE CHOKE MANIFOLD
THIS SYSTEM IS ACTIVATED BY : -

1) Manual pull buttons.
2) Pneumatic hi/lo pilots.

THIRD STAGE

Pressure safety valves (PSV) venting to safe areas from the following points:

1) 2 PSV's located on the separator and scrubber vessels to allow for pressure relief.
2) 2 PSV's & PSE located on steam exhanger vessel to allow for pressure relief in case of over pressure of steam vessels.
3) PSV's located on surge tanks to allow for pressure relief.

This system is designed to protect from any blockage/rupture in the well test train between the rig floor and burners

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT: FLOWLINE UPSTREAM OF SAND KNOCKOUT FA-1	Customer: bp Rig: q-4000 Updated: 07 June, 10	Job N°:
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
10K FLOW SEGMENT				
LEAK	DETERIORATION	OIL & GAS DETECTED AT SURFACE	ESD	NONE
	RUPTURE	LOW PRESSURE	PSL-101	ESD

NOTE 1: PSV & PSH NOT REQUIRED ON FLOWLINE SEGMENT, WORKING PRESSURE >SITP

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT: SAND KNOCKOUT VESSEL SKO-001	Customer: bp Rig: Q-4000 Well: MACONDO INTERVENTI Job N°: Updated: 07 June, 10	
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
15K FLOW SEGMENT LEAK	DETERIORATION	OIL & GAS DETECTED AT SURFACE	ESD	NONE
	RUPTURE	LOW PRESSURE	PSL-001	ESD

NOTE 1: PSV & PSH NOT REQUIRED ON VESSEL SEGMENT, WORKING PRESSURE >SITP

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT : FLOWLINE DOWNSTREAM OF SAND KNOCKOUT FA-2	Customer : bp Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June, 10	Job N° :
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION	
			PRIMARY	SECONDARY
5K FLOW SEGMENT LEAK	DETERIORATION	OIL & GAS DETECTED AT SURFACE	ESD	NONE
	RUPTURE	LOW PRESSURE	PSL-001	ESD

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT : FLOWLINE DOWNSTREAM OF CHOKE MANIFOLD FA-3	Customer : bp Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June, 10	Job N° :
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
6K FLOW SEGMENT				
OVERPRESSURE	CHOKE FAILURE ON CHOKE MANIFOLD	HIGH PRESSURE	PSHL-301	ESD
	BLOCKED LINE		PSHL-303	
LEAK	DETERIORATION	OIL & GAS DETECTED AT SURFACE	ESD	NONE
	RUPTURE	LOW PRESSURE	PSHL-301	ESD

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT: STEAM EXCHANGER HBG-0500	Customer: bp Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June 10	Job N° :
UNDESIRABLE EVENT	**CAUSE**	**DETECTABLE CONDITION AT COMPONENT**	**PROTECTION**	
			PRIMARY	**SECONDARY**
HYDROCARBON TUBE 10k OVERPRESSURE LEAK	**(UPSTREAM SECTION)** BLOCKED OUTLET BLOCKED LINE DETERIORATION RUPTURE	HIGH PRESSURE LOW PRESSURE SHELL - HIGH PRESSURE	PSH-0500	ESD
HYDROCARBON TUBE 1.4K OVERPRESSURE LEAK	**(DOWNSTREAM SECTION)** BLOCKED OUTLET DETERIORATION RUPTURE ACCIDENT	HIGH PRESSURE LOW PRESSURE SHELL - HIGH PRESSURE	PSH-0500	PSV-0500B
STEAM SHELL OVERPRESSURE LEAK	COIL RUPTURE DETERIORATION RUPTURE ACCIDENT	HIGH PRESSURE LOW PRESSURE	PSH-0500 NONE NOTE 1	PSV-0500B, ESD NONE
NOTE 1: PSL NOT REQUIRED AS MINIMUM OPERATING PRESSURE IS ATMOSPHERIC PRESSURE OR FREQUENTLY VARIES TO ATMOSPHERIC WHILE IN SERVICE				

Canal Energy Boiler w/ standard safety systems.
Insulated hard pipe for steam lines.
Hoses for return condensate. Use pipe covers.

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT: STEAM EXCHANGER HBG-0600	Customer: bp Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June 10	Job N°:
UNDESIRABLE EVENT	**CAUSE**	**DETECTABLE CONDITION AT COMPONENT**	**PROTECTION PRIMARY**	**SECONDARY**
HYDROCARBON TUBE 10k OVERPRESSURE LEAK	**(UPSTREAM SECTION)** BLOCKED OUTLET BLOCKED LINE DETERIORATION RUPTURE	HIGH PRESSURE LOW PRESSURE SHELL - HIGH PRESSURE	PSH-0500	ESD
HYDROCARBON TUBE 1.4K OVERPRESSURE LEAK	**(DOWNSTREAM SECTION)** BLOCKED OUTLET DETERIORATION RUPTURE ACCIDENT	HIGH PRESSURE LOW PRESSURE SHELL - HIGH PRESSURE	PSH-0500	PSV-0500B
STEAM SHELL OVERPRESSURE LEAK	COIL RUPTURE DETERIORATION RUPTURE ACCIDENT	HIGH PRESSURE LOW PRESSURE	PSH-0500 NONE NOTE 1	PSV-0600A,0600B, ESD NONE
NOTE 1: PSL NOT REQUIRED AS MINIMUM OPERATING PRESSURE IS ATMOSPHERIC PRESSURE OR FREQUENTLY VARIES TO ATMOSPHERIC WHILE IN SERVICE				

Canal Energy Boiler w/ standard safety systems.
Insulated hard pipe for steam lines.
Hoses for return condensate. Use pipe covers.

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT: FLOWLINE UPSTREAM OF SEPARATOR FA-4	Customer: bp Rig: Q-4000 Well: MACONDO INTERVENTION Updated: 07 June, 10	Job N°:
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION	
			PRIMARY	SECONDARY
1.4K FLOW SEGMENT UPSTREAM Vx				
OVERPRESSURE	CHOKE FAILURE ON STEAM EXCHANGER BLOCKED LINE	HIGH PRESSURE	PSHL-301 PSHL-303	ESD ESD
LEAK	DETERIORATION RUPTURE	OIL & GAS DETECTED AT SURFACE LOW PRESSURE		
1.4K FLOW SEGMENT DOWNSTREAM Vx				
OVERPRESSURE	CHOKE FAILURE ON STEAM EXCHANGER BLOCKED LINE	HIGH PRESSURE	PSHL-301 PSHL-303	ESD ESD
LEAK	DETERIORATION RUPTURE	OIL & GAS DETECTED AT SURFACE LOW PRESSURE		

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT: FLOWLINE DOWNSTREAM OF SEPARATOR FA-5	Customer: bp Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June, 10	Job N°:
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
GAS LINE UPSTREAM GAS SCRUBBER OVERPRESSURE LEAK	BLOCKED LINE DETERIORATION RUPTURE	HIGH PRESSURE OIL & GAS DETECTED AT SURFACE LOW PRESSURE	PSHL-202	ESD
LIQUID LINES UPSTREAM OF TANKS OVERPRESSURE LEAK	BLOCKED LINE DETERIORATION RUPTURE	HIGH PRESSURE OIL & GAS DETECTED AT SURFACE LOW PRESSURE	PSHL-202	ESD

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT : SEPARATOR FLOWLINE SEGMENTS MBD-1000	Customer : bp Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June, 10	Job N° :
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
OVERPRESSURE	BLOCKED OUTLET	HIGH PRESSURE	PSH-1000	PSV-1001, PSV-1002
UNDERPRESSURE	OUTFLOW EXCEEDS INFLOW	LOW PRESSURE	PSL-1000	ESD
OVERFLOW	INFLOW EXCEEDS OUTFLOW LEVEL CONTROL FAILURE	HIGH LIQUID LEVEL	LSH-1000 NOTE 1	ESD
GAS BLOW-BY	LEVEL CONTROL FAILURE	LOW LIQUID LEVEL	LSL-1001 NOTE 2	ESD
LEAK	DETERIORATION	LOW PRESSURE AND BACK FLOW	PSL-1000	ESD

NOTE 1 : EQUIPMENT DOWNSTREAM CAN SAFELY HANDLE LIQUID CARRY-OVER. SEPARATOR CONTINUOUSLY MANNED DURING OPERATIONS

NOTE 2 : SEPARATOR CONTINUOUSLY MANNED DURING OPERATIONS

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT : HP FLARE SCRUBBER MBF-1200	Customer : bp Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June, 10	Job N° :
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	PROTECTION SECONDARY
OVERPRESSURE	BLOCKED OUTLET	HIGH PRESSURE	PSH-1200	PSV-1200, PSV-1201
UNDERPRESSURE	OUTFLOW EXCEEDS INFLOW	LOW PRESSURE	PSL-1200	ESD
OVERFLOW	INFLOW EXCEEDS OUTFLOW LEVEL CONTROL FAILURE	HIGH LIQUID LEVEL	LSH-1200 NOTE 1	ESD
GAS BLOW-BY	LEVEL CONTROL FAILURE	LOW LIQUID LEVEL	LSL-1200	ESD
LEAK	DETERIORATION	LOW PRESSURE AND BACK FLOW	PSL-1200	ESD

NOTE 1 : EQUIPMENT DOWNSTREAM CAN SAFELY HANDLE LIQUID CARRY-OVER. SEPARATOR CONTINUOUSLY MANNED DURING OPERATIONS

NOTE 2 : EQUIPMENT DOWNSTREAM CAN SAFELY HANDLE GAS RATES THAT CAN BE DISCHARGED THROUGH LIQUID OUTLET SEPARATOR CONTINUOUSLY MANNED DURING OPERATIONS

Schlumberger	SAFETY ANALYSIS TABLE	COMPONENT : SURGE TANKS FLOWLINE SEGMENTS	Customer BP Rig: Q-4000 Well: MACONDO INTERVENTION Job N° Updated: 07 Jun. 10	
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
MBJ-2100				
OVERPRESSURE		HIGH PRESSURE	PSH-2100 NOTE 1	PSV-2100
UNDERPRESSURE	OUTFLOW EXCEEDS INFLOW	LOW PRESSURE not a risk	VENT NOTE 1	NONE
OVERFLOW	PUMP FAILURE/MALFUNCTION BLOCKED LIQUID OUTLET	HIGH LIQUID LEVEL	LSH-2100 NOTE 1	Manual ESD button on tank
GAS BLOW-BY	OUTFLOW EXCEEDS INFLOW excess gas sent to barge	LOW LIQUID LEVEL	LSL-2100 NOTE 1	NONE
LEAK	DETERIORATION RUPTURE ACCIDENT	LOW PRESSURE AND BACKFLOW	Manual ESD	NONE
MBJ-2200				
OVERPRESSURE	BLOCKED OUTLET	HIGH PRESSURE	PSH-2200 NOTE 1	PSV-2200
UNDERPRESSURE	OUTFLOW EXCEEDS INFLOW	LOW PRESSURE not a risk	VENT NOTE 1	NONE
OVERFLOW	PUMP FAILURE/MALFUNCTION BLOCKED LIQUID OUTLET	HIGH LIQUID LEVEL	LSH-2200 NOTE 1	Manual ESD button on tank
GAS BLOW-BY	OUTFLOW EXCEEDS INFLOW excess gas sent to barge	LOW LIQUID LEVEL	LSL-2200 NOTE 1	NONE
LEAK	DETERIORATION RUPTURE ACCIDENT	LOW PRESSURE AND BACKFLOW	Manual ESD	NONE
MBJ-2300				
OVERPRESSURE	BLOCKED OUTLET	HIGH PRESSURE	PSH-2300 NOTE 1	PSV-2300
UNDERPRESSURE	OUTFLOW EXCEEDS INFLOW	LOW PRESSURE not a risk	VENT NOTE 1	NONE
OVERFLOW	PUMP FAILURE/MALFUNCTION BLOCKED LIQUID OUTLET	HIGH LIQUID LEVEL	LSH-2300 NOTE 1	Manual ESD button on tank
GAS BLOW-BY	OUTFLOW EXCEEDS INFLOW excess gas sent to barge	LOW LIQUID LEVEL	LSL-2300 NOTE 1	NONE
LEAK	DETERIORATION RUPTURE ACCIDENT	LOW PRESSURE AND BACKFLOW	Manual ESD	NONE

LIQUID LEVEL NOT AUTOMATICALLY MAINTAINED IN THE VESSEL. FILLING AND EMPTYING OPERATIONS CONTINUOUS

NOTE 1 PSL NOT REQUIRED AS MIN. OPERATING PRESSURE IS ZERO OR PRACTICALLY VARIES TO ZERO

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT : PUMPS FLOWLINE SEGMENTS	Customer : bp Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June, 10	Job N° :
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
OVERPRESSURE	BLOCKED DISCHARGE LINE	HIGH PRESSURE	NOTE 1 NONE	NOTE 2
LEAK	DETERIORATION RUPTURE ACCIDENT	LOW PRESSURE AND BACKFLOW	NONE NOTE 1	NONE

NOTE 1 : PUMP IS CONTINUOUSLY MANNED

NOTE 2 : PUMP MAXIMUM DISCHARGE PRESSURE IS LESS THAN 70% OF MAWP OF DISCHARGE PIPING

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT: PUMPS MBJ-2100,2300,2400	Customer: BP Rig : Q-4000 Well : MACONDO INTERVENTION Job N° : Updated: 07 June, 10	
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
OVERPRESSURE	BLOCKED DISCHARGE LINE	HIGH PRESSURE	NOTE 1 NONE	NOTE 2
LEAK	DETERIORATION RUPTURE ACCIDENT	LOW PRESSURE AND BACKFLOW	NONE NOTE 1	NONE

NOTE 1 : PUMP IS CONTINUOUSLY MANNED

NOTE 2 : PUMP MAXIMUM DISCHARGE PRESSURE IS LESS THAN 70% OF MAWP OF DISCHARGE PIPING

Schlumberger SAFETY ANALYSIS TABLE		COMPONENT : STEAM BOILER "VESSEL" MAC 5100/5200	Customer : Rig : Q-4000 Well : MACONDO INTERVENTION Updated: 07 June 10	Job N° :
UNDESIRABLE EVENT	CAUSE	DETECTABLE CONDITION AT COMPONENT	PROTECTION PRIMARY	SECONDARY
OVERPRESSURE	BLOCKED OUTLET BLOCKED LINE	HIGH PRESSURE STEAM	PSH-5100,5101,5102 PSH-5200,5201,5202	PSV-5100, 5101 PSV-5200, 5201
OVERHEAT	TEMP. CONTROLER FAILURE	TEMP. GAUGE EXCEEDS OPERATING TEMP.	TSH-5100	ESD
FLAME FAILURE	AIR BLOWER DIESEL PUMP	SUDDEN DROP IN TEMP.	BSL-5100	ESD
LOW WATER LEVEL	PUMP FAILURE	LOSE OF STEAM	LSL-5100, 5101	NONE
LEAK	DETERIORATION RUPTURE	LOW PRESSURE SHELL - HIGH PRESSURE	LSL 5100, 5102 PSH-5100,5101,5102 PSH-5200,5201,5202	ESD ESD
NOTE: BOILERS ARE CONTINUOUSLY MANNED DURING OPERATIONS.				

Attachment 16: Landing String Specifications

FOR REFERENCE ONLY

WORKSTRINGS, LLC

Drill Pipe Performance Characteristics ©

Pipe Size and Weight: 6-5/8" 0.522 EU
Pipe Grade: V-150
Range: 2
Tool Joint: 8.500 X 5.500 GTM69

Pipe

Note: Pipe properties are calculated based on uniform OD and wall thickness.

	New (Nominal)	95% RBW	90% RBW	Premium
OD (in)	6.625	6.573	6.521	6.416
Nominal Wall thickness (in)	0.522	0.496	0.470	0.418
Nominal ID (in)	5.581	5.581	5.581	5.581
Calculated plain end weight (lbs/ft)	34.624	32.185	30.360	26.754
Torsional strength (ft-lbs)	204,400	193,100	181,900	159,900
Tensile strength (lbs)	1,501,300	1,420,100	1,339,600	1,180,500
80% Torsional strength (ft-lbs)	163,500	154,500	145,500	127,900
Internal Pressure capacity (psi)	20,583	22,456	21,274	18,910
Collapse capacity (psi)	20,057	18,383	16,692	13,197

	New (Nominal)	95% RBW
Cross sectional area pipe body (in²)	10.008	9.467
Cross sectional area OD (in²)	34.472	33.931
Cross sectional area ID (in²)	24.463	24.463
Section modulus (in³)	14.170	13.386
Polar section modulus (in³)	28.340	26.773

Notes: New = 100% RBW. Premium = 80% RBW.
Internal Pressure capacity for New based on 87.5% RBW per API. Internal Pressure capacity = Burst.

Tool Joint (135000 material Yield Strength)

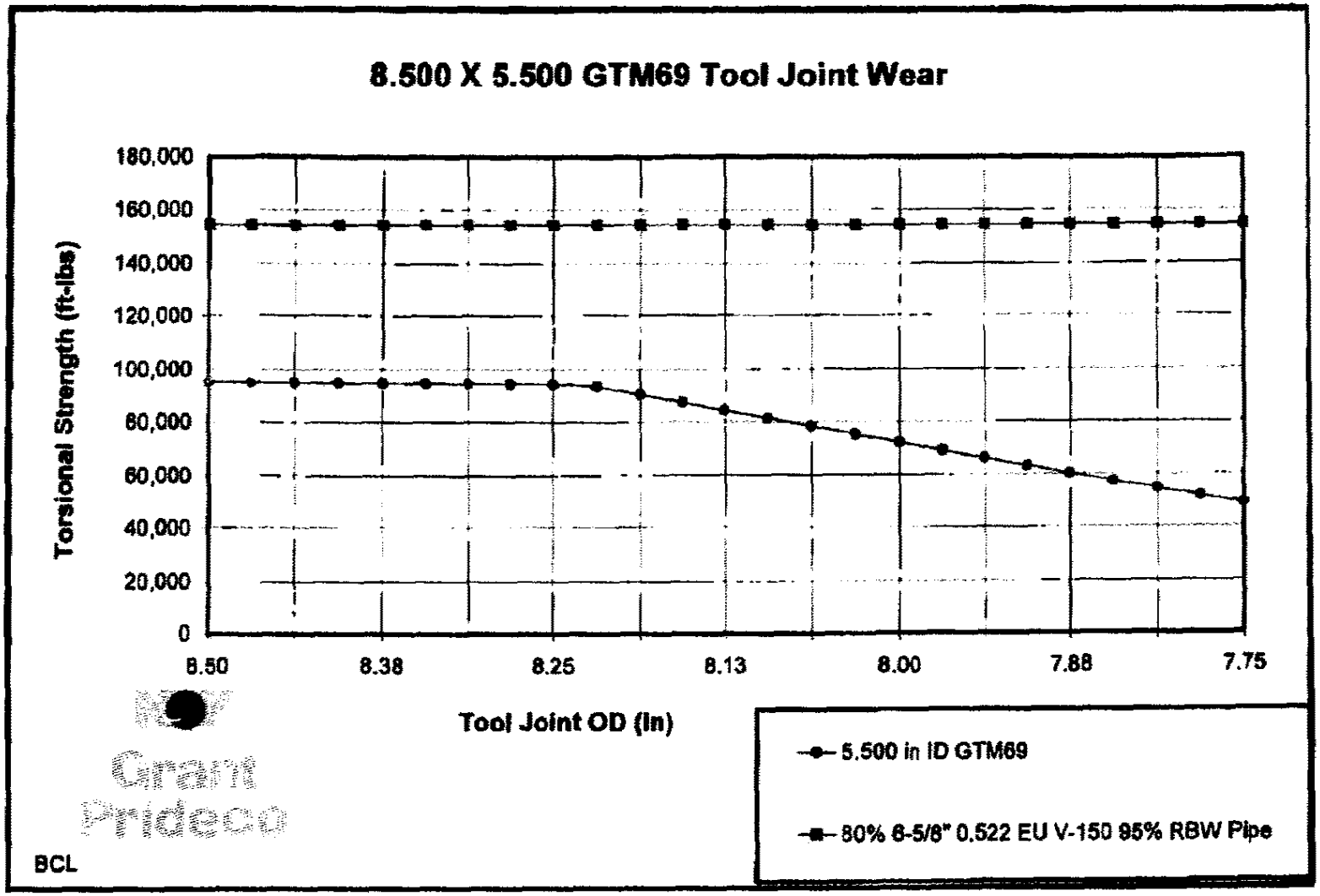
GTM69	
OD (in)	8.500
ID (in)	5.500
Pin long length (in)	12.0
Box long length (in)	17.0
Torsional Strength (ft-lbs)	95,300
Max Recommended Make-up Torque (ft-lbs)	50,800
Min Recommended Make-up Torque (ft-lbs)	42,400
Bolance OD (in)	8.227
Tensile strength (lbs)	1,695,200
Tool joint/Drill pipe torsional ratio (New pipe)	0.41
Tool joint/Drill pipe torsional ratio (Prem pipe)	0.53
Minimum OD for Premium	Not Appl.

Min and Max MUT based on 135,000 psi SMYS.

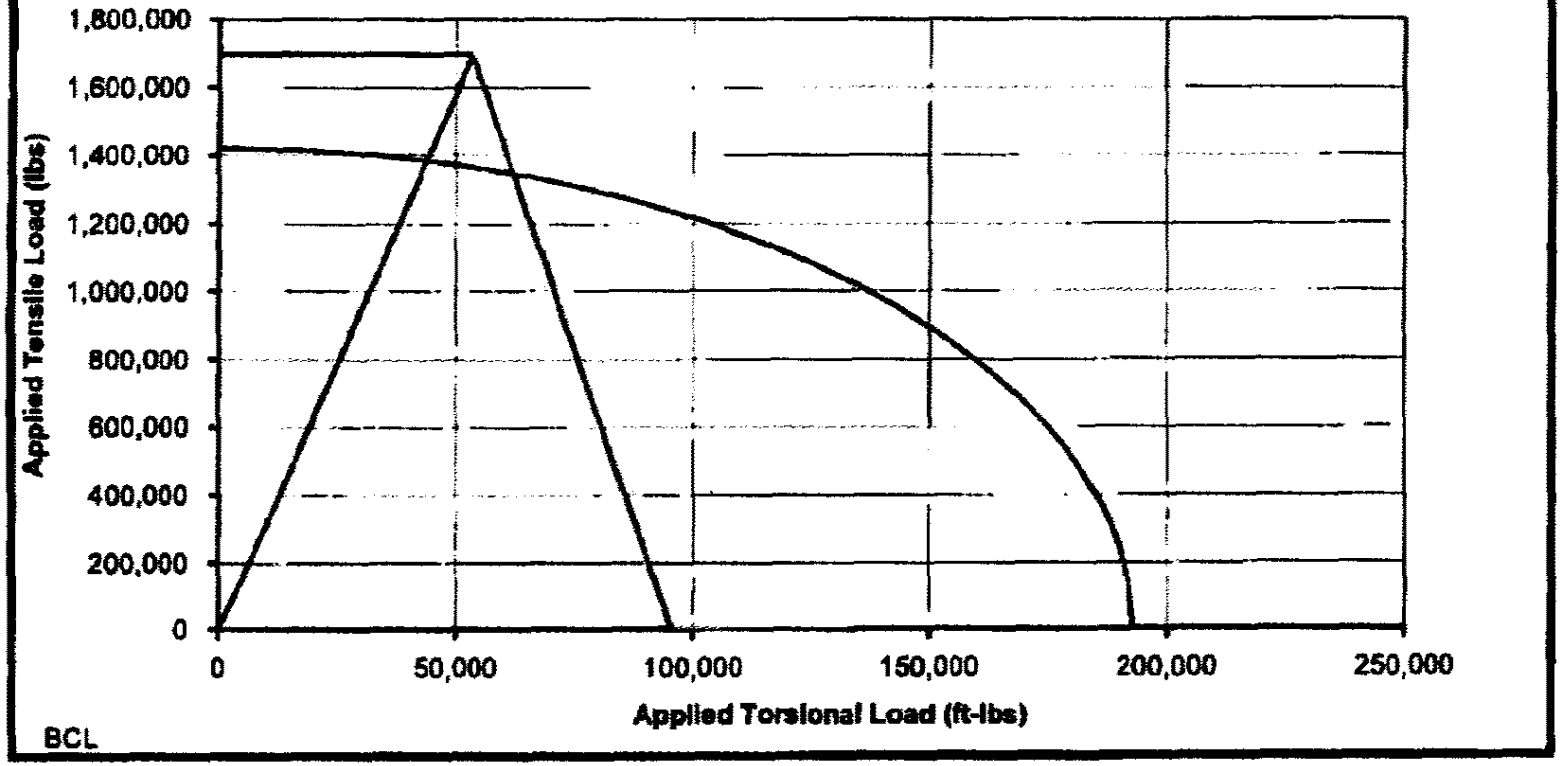
Drill Pipe assembly with Grant Prideco GTM69 eXtreme™ Torque Connection

	New (New guaranteed 95% RBW Pipe with IPC)	(without IPC)
Adjusted weight (lbs/ft)	42.41	
Approximate length (ft)	32.18	
Fluid displacement (gal/ft)	0.655	
Fluid capacity (gal/ft)	1.235	1.242
Fluid capacity (bls/ft)	0.0294	0.0296
Drift size (in)	5.375	
Pipe Wall (in)	0.560	
Pipe ID (in)	5.505	
Pipe OD (in)	6.625	

Notes: The drill pipe assembly calculations account for the adjusted ID in the manufacture of 95% RBW guaranteed pipe with 0.009" internal plastic coating
New pipe guaranteed to 95% RBW will have a smaller ID than new pipe guaranteed to 87.5% RBW


8.500 X 5.500 GTM69 Tool Joint Wear
Torsional Strength (ft-lbs)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
8.50
8.38
8.25
8.13
8.00
7.88
7.75
Tool Joint OD (In)
5.500 in ID GTM69
80% 6-5/8" 0.522 EU V-150 95% RBW Pipe
Grant Prideco
BCL

Torque Tension Curve: 6-5/8" 0.522 EU V-150 95% RBW Class Drill Pipe with 8.500 X 5.500 GTM69 eXtreme™ Torque Tool Joint. Curve Based on Calculation Method in API RP7G. Safety Factor =1.0



Attachment 17: Q4000 Contact List

Q4000 CONTAINMENT PROJECT June 6 2010					
COMPANY	SERVICE	CONTACT	PHONE	CELL	E-MAIL
REGULATORY					
MMS	Drilling & Production Oversight	Troy Trosclair	281-366-1467	504-450-2338	troy.trosclair@mms.gov
MMS	Drilling & Production Oversight	Bryan Domangue	281-366-1467	985-351-4832	bryan.domangue@mms.gov
US Coast Guard	Marine Oversight	Lt. Matt Beck	281-366-5140	509-999-8381	matthew.m.beck@uscg.mil
US Coast Guard	Marine Oversight	Lt. Bryson Spangler	281-366-5140	206-992-4264	bryson.t.spangler@uscg.mil
VENDORS					
Aggreko	Air Compressors	Mary Duhon		337-560-8165	mary.duhon@aggreko.com
Aggreko	Air Compressors	Barry Gautreau	337-560-8187	337-380-5263	barry.gautreau@aggreko.com
Aggreko	Air Compressors	Jeff Loveless	337-365-5479	337-380-2275	jeff.loveless@aggreko.com
Anadarko	Completion Engineer	Dennis McDaniel	832-636-8764	281-705-8419	dennis.mcdaniel@anadarko.com
Atkins	Process Safety	Alistair Warwick	713-576-8500	281-235-5216	alistair.warwick@atkinsglobal.com
Burner Fire Control	Fire Safety Services	Butch Ridgedell	337-237-4647	337-298-8757	bridgedell@burnerfire.com
C Port #1, Slip 1	BP Loading Dock Facility	Brad Dartez	337-735-5726		brad.dartez@bp.com
Canal Energy Services	Boiler System	Terry Rutherford	985-732-3053	504-388-1566	trutherford@canalenergy.com
Magnum Mud	Chemical tanks	Bobby Forst	1-800-230-6285		bobbyf@magnummud.com
Nalco	Chemicals	John Nicholas	281-366-5428	251-490-4964	jcnicholas@nalco.com
Professional Wireline	Solids Knock Out	Jared Monk	318-221-8150	337-581-6069	jaradm@professionalwireline.com
QPS	ESD Systems	Azam (MO) Mohammed	985-868-1200	504-419-0904	mo@qps-la.com
Schlumberger	SWT Design	Randall Reynolds		832-367-0028	RReynold@slb.com
Schlumberger	SWT Design	Mike Adam	281-285-1575	281-415-0336	adam2@slb.com
Schlumberger	SWT Equipment	Mike Duplantis	985-580-7447	281-961-6853	duplantis2@slb.com
Schlumberger	SWT Equipment	Sam Shanklin		985-859-0715	snanklin1@slb.com
Schlumberger	SWT Manager	Mahendra Kunju	985-580-7589	985-226-8848	mkunju@houma.oilfield.slb.com
Schlumberger	SWT Equipment Logistics	Kirk Bogard		985-855-7199	kbogard@slb.com
Technip	Drafting Services	Shawn Berg	281-249-1738	713-516-6469	svberg@technip.com
Total Safety	Air Monitor Services	Daniel Penaloza		832-552-3122	dapenaloza@totalsafety.com
Q4000 OPERATIONS					
Helix	Rig Manager	Ray Milne		281-733-0282	rmilne@helixesg.com
Helix	Rig Manager	Callum Cook		936-827-9870	ccook@helixesg.com
BP OPERATIONS					
BP	Operations WTL	George Gray	281-366-0659	713-376-1099	george.gray@bp.com
BP	Operations WTL	John Smart	832-593-8493	832-593-8493	jsmartjr@bp.com
BP	Operations WTL	Jim Wellings	281-366-2903	713-715-9334	james.wellings@bp.com
BP	Engineer - Ops Support	Mike Fowler	281-366-3553	281-799-8373	Mike.Fowler@bp.com
BP	Engineer - Ops Support	Lee Richard	281-366-8145	281-740-9981	Lee.Richard@bp.com
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Attachment 18: Q4000 Shut Down Requirements

Q4000 Containment Shutdown Requirements

Doc.: 2200-T2-DO-RP-4174 | Date: 19 June 2010 | Revision: REV.0

USE THIS DOCUMENT WITH: 2200-T2-DO-PR-4165 (Planned / Emergency Disconnect and Reconnect Procedure)

Rev History: Released for Approval - 9 June 2010

Instructions:

1.) Review the Event; 2.) Perform Appropriate Shut Down Level; 3.) Perform Disconnect Sequence; 4.) Perform Post Shut Down Response

	1. Event	2. Shut Down Level (Note 1)		4. Post Shut Down Response (Note 4)
1	Small Leak anywhere in the subsea production system	Continue Flow Back	No Disconnect	1. Discuss with BP command / operations
2	Small Leak anywhere in the surface process system (below MWL)	PSD1	No Disconnect	1. Ensure personnel a safe distance from the leak source 2. Discuss with BP command / operations, repair leak and reevaluate restart on flow back
3	Large Leak or Total Loss of Containment anywhere in subsea flow path	PSD1	No Disconnect	1. BOP valves should close on their own. Verify BOP valves are closed w/ROV and monitor subsea acoustic gauges on the gooseneck at the BOP. 2. Close all manifold isolation valves 3. Discuss with BP command / operations, repair leak and reevaluate restart of flow back
4	Large Leak or Total Loss of Containment anywhere in the surface process system or subsea flow path	ESD	No Disconnect	1. Verify BOP valves are closed w/ROV and monitor subsea acoustic gauges on the gooseneck at the BOP 2. Close all manifold isolation valves 3. Discuss with BP command / operations, repair leak and reevaluate restart of flow back
5	Loss of Q4000 station keeping *(Reference Note: Q4000 WSOC)*	ESD	Emergency Disconnect at LDI3 when EDS switch circle is reached LDI3 watch circles as follows: GREEN: 33-ft (10 m) YELLOW: 41-ft (12.5 m) RED: 46-ft (14 m) *Reference BP Document 4412 - Operability Guide for LDI3 Operation on MC252-1*	1. ROV vessels to maintain station if possible - if unable to safely maintain station, vessels to keep clear of drift path of Q-4000 2. Re-adjust subsea MEOH injection at the Top Hat to 5-gpm. 3. Adjust vents and dispersant injection on the Top Hat. 4. Record Shut in pressure for future reference 5. Verify the C/K BOP valves are closed using ROV from another vessel 6. If possible close manifold valves using ROV from another vessel.
6	Loss of station keeping on any boat - drifting towards Q4000 *(Reference Note: Q4000 WSOC)*	ESD	Emergency Disconnect at LDI3	1. Move out of the path of the approaching boat. 2. Re-adjust subsea MEOH injection at the Top Hat to 5-gpm. 3. Adjust vents and dispersant injection on the Top Hat. 4. Record Shut in pressure for future reference. 5. Verify the C/K BOP valves are closed using ROV from another vessel. 6. If possible close manifold valves using ROV from another vessel
7	Loss of station keeping by any boat - drifting away from Q4000 *(Reference Note: Q4000 WSOC)*	Continue Flow Back	No Disconnect	1. Continue flow back. 2. Monitor status and position of the boat that lost station
8	Yellow LEL on Q4000 (10%) *(Reference Note: Q4000 WSOC Air Quality Impacts) (Reference: OFFSHORE Air Monitoring Plan for Source Control 2200-T2-DO-PN-4002)*	Continue Flow Back	No Disconnect	1. Continue operations per instructions defined Field Simops Plan (Diving Vessel - Well Specific Operational Criteria - Air Quality)
9	Orange LEL on Q4000 (20%) *(Reference Note: Q4000 WSOC Air Quality Impacts)*	PSD1	No Disconnect or Planned Disconnect	1. Navigate whether there are plans for the Q4000 to depart the field, if departure is expected, crew should begin Planned Disconnect 2. If Planned Disconnect is performed, when safe - remove BOP pod and 1450 ft jumpers to the manifold. 3. Perform system pressure test per intervention program and evaluate readiness to flow back operation
10	Red LEL (40%) on Q4000 - instantaneous reading confirmed by 2 or more monitors Or VOC at 1000ppm for greater than 15 min Or Benzene at 10ppm in living quarters for 15 min and confirmed by two instruments Or CO at 25ppm for greater than 15 min Or H2S at 3 ppm for greater than 15 min *(Reference Note: Q4000 WSOC Air Quality Impacts) (Reference: OFFSHORE Air Monitoring Plan for Source Control 2200-T2-DO-PN-4002)*	ESD	Emergency Disconnect at LDI3	1. Move vessel to a safe location 2. Re-adjust subsea MEOH injection at the Top Hat to 5-gpm 3. Adjust vents and dispersant injection on the Top Hat 4. Record Shut in pressure for future reference 5. Verify the C/K BOP valves are closed using ROV from another vessel. 6. If possible close manifold valves using ROV from another vessel.
11	Loss of BOP control (PETU or major leak at Hot Line)	PSD1	No Disconnect	1. For small leak on hot line continue flow back and monitor tank volume before Common, TOL, BP WSL, Odd and Command Center in Houston 2. Hold location while trouble-shooting MUX system or Hotline 3. Implement contingency plans to repair BOP control system
12	Surface Entanglement of oil plume	Continue flow back or PSD1 if departure from location is expected (Note 3)	Planned Disconnect (Note 3)	1. Move vessel out following an escape route if clearance was performed 2. If clearance was made to continue flowing, consider using dispersants at Q4000 location - evaluate mitigations with the command.
13	Loss of visibility with the ROV	Continue Flow Back	No Disconnect	1. Continue flow back, attempt use of another ROV if there is ROV problem with the current ROV
14	Major Production Upset (< 6 hour recovery)	PSD2	No Disconnect	1. Ensure BOP valves are still open 2. Maintain subsea Methanol injection 3. Isolate problem, develop side action plan, and correct the problem. 4. Enterprise will monitor Top Hat and adjust vent valves as necessary and adjust dispersant injection
15	Hurricane enters Gulf of Mexico and is within 72hrs + escape time of the Q4000	PSD1	Planned Disconnect	1. Transit the vessel to a safe location 2. After hurricane passes, return to field, evaluate the subsea kit, reconnect, and resume flowback if possible.

SHD Levels	Shut Down Sequence (Refer to 2200-T2-DO-PR-4165)
	1 Close the ball valve (BV) LDI3 at the PBC WOCs Reel
	2 GO TO STEP 3 of DISCONNECT SEQUENCE if DISCONNECT IS REQUIRED. Otherwise go to Step 3, below.
	3 Using PETU, close C/K lines on the BOP.
	4 Shut down surface flow at the choke manifold followed by closing of the swing valve and master valve on the surface flow riser
	1 Inform Enterprise of intent to shut in
	2 Shut in at surface per 2200-T2-DO-PR-4154 - Long Term Shut Down (LTSD) Section
	3 Flush and prepare for riser disconnect per 2200-T2-DO-PR-4165 - Planned Riser and Disconnect Section
	1 Inform Enterprise of intent to shut in 2 Shut in at surface riser head vent valve (SRV) per 2200-T2-DO-PR-4154 - Planned Short Term Shut Down Section. No disconnect option will be performed as a part of short term shut-down

Emergency Disconnect at the Lower Marine Connector (LMC) on the LRA1	
1 PERFORM STEP 1 ESD SHUTDOWN SEQUENCE	
2 Immediately after initiating of the closure of the RAV, PMC will perform emergency disconnect of the QRC by applying pressure to the "unlock" sop of the QRC connector. As CH COC moves off station the BOP MUX and hot lines will be severed by a guillotine mounted subsea. (RETURN TO STEP 3 and 4 of the ESD)	78 sec
Disconnect at the LRA1, Lay Down, Retrieve Riser and Pod	TOTAL: 43 hrs (1.8 days)
1 PERFORM STEPS 1, 2, & 3 on PSD1 SHUTDOWN SEQUENCE	
2 Deploy Q4000 crane and connect it to the recovery slings on LRA1. Take up tension.	
3 Function QRC connector unlock and pick up 10 ft with LRA2.	
4 Pull LDI3 to surface.	
5 While pulling LDI3, move rig crane and set the LRA1 on dolphin mattresses pre-deployed in lay down area.	
6 Move Subsea Vessel or Q4000 over the BOP and connect the crane to the BOP Pod	
7 Unseam the BOP Pod from the BOP	
8 Hold onto the pod and move ship along with Q4000 or have off the pod to Q4000	
9 Recover pod and riser to surface	

NOTES:

Note 1: Refer to document 2200-T2-DO-PR-4152 - Operability Guide for LDI3 for details on the operational window of the LDI3 (Light Duty Intervention System) during flowback operation to ensure that weather conditions, watch circles, and other operating parameters are favorable to start pumping operations.

Note 2: Ensure that the following documents are available for reference: Operability Guidance for LDI3 Operations - 2200-T2-DO-PR-4152; Planned / Emergency Disconnect and Reconnect Procedure - 2200-T2-DO-PR-4165; Q4000 Containment Startup, Flowback and Shutdown Procedure; 2200-T2-DO-PR-4154.

Note 3: Prior to performing planned disconnect, evaluate risk of contaminig flow back when the oil plume is at the vessel.

Note 4: Manifold valves are operated with an ROV and may take significant amount of time to arrange to required configuration.

Note 5: Q4000 utilizes a series of lights providing information to the rig about status of power, watch circles, and emergency status. "Yellow" light does not correlate to the PSD/ESD commands. However a "Red" light does signify a command to perform an ESD and Emergency Disconnect.

Note 6: Post Shutdown Response outlines only providers a guidance for steps that should be performed after a shutdown or disconnect sequence has been completed. Post shutdown responses may consist of ROV interventions or investigations performed on the Q4000 or supporting vessels. Detailed work plan needs to be developed based on these guidelines.

PRE PRODUCTION INSPECTION Q-4000
JUNE 13, 2010

MMS
Troy Trosclair
Phil McLean

BP
George Gray (BP)
Marvin Morrison (Consultant)
Carl Welch (BP Test)
Mike Ward (BP)

USCG
Ray Curreva
John Carpenter

D-4000
Keith Shorts, Captain

Need Poly Flow, TSE over Flow head and have it function ESD. Complete

Need procedure No lifts over flow head (master valve is fail as is, wing is fail safe) This is in procedures to have no lifting over pressurised lines. All additional lifting will only be approved under a permit to work system

Need procedure to Manually operate from slave panel the master valve in the event of a leak in the swivel or drill pipe below the master. Manned operation (continuous w/backup) Note: add to SAFE Chart It is possible to close the Master valve when the panel is in ESD Mode. The position of the panel will also be optimized to minimse risk of access in the event of an incident

Consider adding pump to reduce closure time on Master valve An additional pump has been added to try and improve timing – this has not created a significant improvement and we are looking to get an accumulator pack for this system to improve timings.

Submit Instrument drawings on Slave Panel

SDV 001 closed in 6 sections from slave (verified), 9 sections from master (verified)
Master Valve Timing only
Will close RIV (Ball valve on LDIS)
4 ½ minutes (work on sequence)

Add checks (redundant) on all chemical injection lines as outlined in flow schematic. These have been installed

Secure chicksan downstream of choke Pipe securing is in hand as we continue to move ahead with relief line reconfiguration and walkways.

Lock open the block valve on the outlet of the heat exchanger HBG-600 This has been locked open with plastic chain.

Relief valve on HBG 500 not routed (possible long term solution to route to 8" line going overboard) If relief out of the top, need to protect exhaust systems from contact. New layout for relief line is being worked to

Need TSE's or polyflow over heat exchange, SKO, choke manifold and have it function ESD. These are complete

Need to LO valves on multi phase meter skid These have been done with chain

Oil lines, LP gas, HP line to boom needs to be secured with cable and braced mechanically (make area off limits) This will be completed before we start operations

~~Secure relief lines overboard~~ will route the separator relief and P-tank relief systems through dual 6 inch lines overboard above the escape capsules to a safe location This is currently being completed

Finish raised walkways and place handrails These will be completed

Need insulated Blankets for protection on hammer unions and other fittings associated with the steam piping systems. These are still pending

Need TSEs or polyflow over MeOH tanks and pumps and have it function ESD These are in place at present

Need TSEs or Poly flow over Oil transfer pumps, need FSv on Discharge piping, discharge piping needs to be rated `1.5 times the max discharge pressure in order to sac the PSH The transfer pumps viewed during the inspection will be replaced by an electric driven pump that will allow much greater burning capacity from the tanks. We will ensure that check valves are in place on the outlet

LCV and LSL on same junction It was confirmed with the Canal Energy team that these were two separate controls that shoulkd not suffer common moide failure

Need rubbing on Steam generators I believe these may have been given to you.

Need PSL on Steam Boilers and have it function shut off of Diesel fuel **These will be put in place**

Need PSL on Separator and have it function ESD **This have been reconfigured and is in place. PSH setting on the Separator PSH1000 has been set at 800psi Additionally The PSH 202 downstream of the has also been adjusted to 800 psi**

Need to add PSL on piping for fire curtain system and have it function ESD **This has been done and has been tested.**

Need procedure on the Slave panel near the flow head to ensure proper valve arrangement prior to start up. **These are being taped to panel and a crosscheck on status will be confirmed with the Driller**

Procedure to describe the communications that will be in place to identify a leak in the subsea jumpers, (PT on gooseneck?) and relaying that information to the Cameron Conex on the Q-4000 and subsequent action. **These are being finalized with the teams in Houston**

Herbst, Lars

From: Domangue, Bryan
Sent: Monday, June 14, 2010 9:19 PM
To: Herbst, Lars; Saucier, Michael
Subject: FW: MMS approval to flush lines to base oil-MC 252 Macondo #1 well
Attachments: BP Macondo Safe_SAT API 14C Forms-Rev6.xls

FYI

From: Kirton, Bill [mailto:Bill.Kirton@bp.com]
Sent: Monday, June 14, 2010 9:14 PM
To: Domangue, Bryan
Cc: Summers, Dawn; Forman, Paul; Gray, George E; Sixt, John E; Hoskins, Brian C.; Richard, Lee (Contractor)
Subject: MMS approval to flush lines to base oil-MC 252 Macondo #1 well

Bryan,
BP will make sure that all items on the MMS Preproduction Inspection List for the Q-4000, dated June 13, 2010 will be complete, before the MC 252 Macondo well is flowed back to Q-4000 test spread.

Additionally, the Rev 6 Schlumberger Safe Chart is enclosed. By completing the above referenced list and sending the Safe Chart, the MMS agrees to allow BP to flush the lines from the Q-4000 to the Horizon BOP stack to base oil and close in the required valves as per procedure 4154. The steps executed will be through 2.3.3.12.

Please return your acceptance of this proposal.

<<BP Macondo Safe_SAT API 14C Forms-Rev6.xls>>
Thanks,
Bill Kirton
Team Leader Surface Engineering Q-4000